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WAR MACHINE

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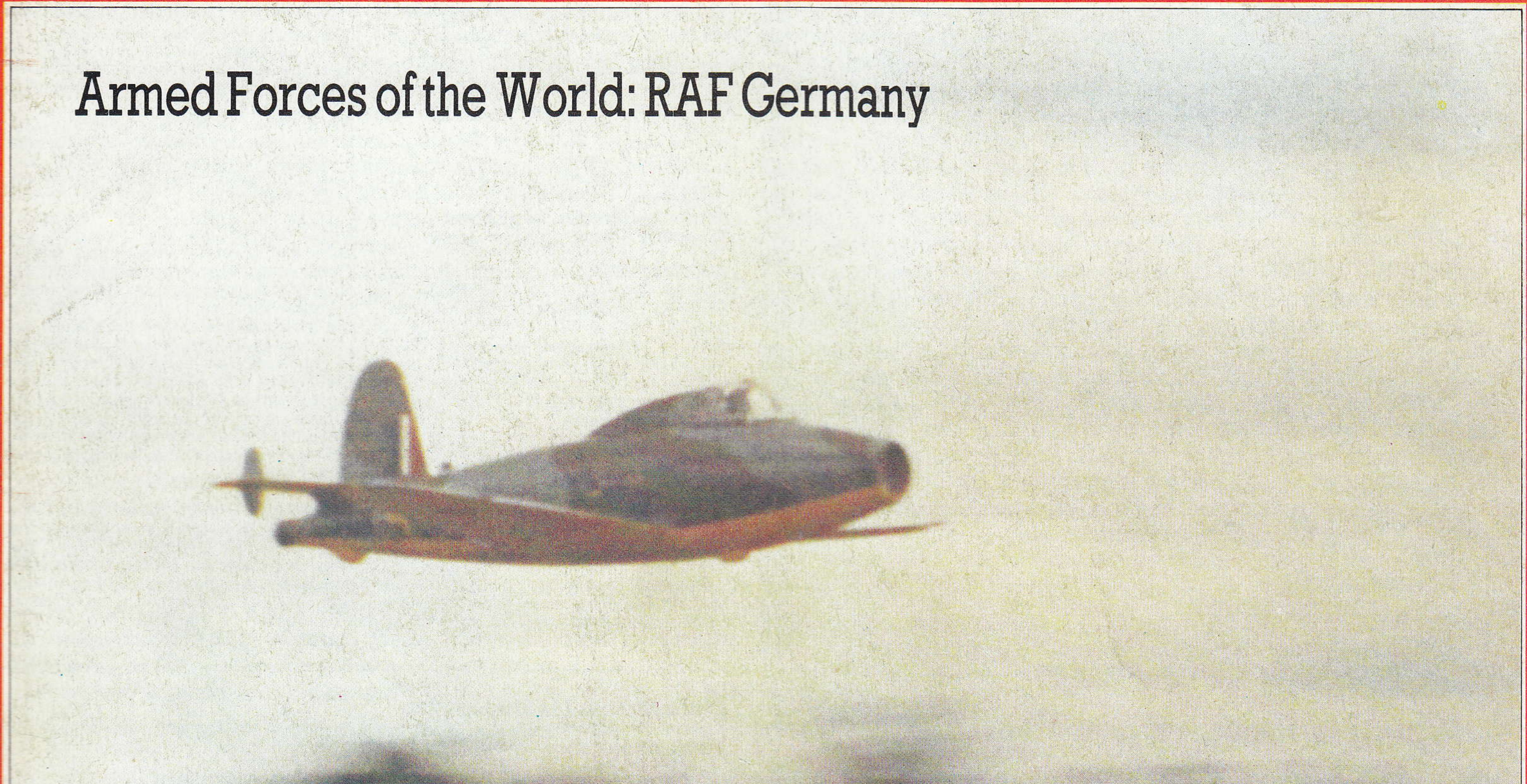

Armed Forces of the World: RAF Germany

Messerschmitt Me 262 in Action

Meteor in Service

German Advanced Designs

An illustrated guide to Jet Aircraft of World War II

WAR MACHINE

Volume 2 Issue 14

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Armed Forces of the World:

RAF Germany iii

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War Machine
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Managing Editor: Stan Morse
Editorial: Trisha Palmer
Chris Bishop
Chris Chant
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Artists:
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Keith Fretwell

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WAR MACHINE
Forthcoming issues feature: Machine-guns of World War II
Modern Assault Rifles
Battleships of World War II
Post-war Bomber Aircraft
Self-propelled Guns and Howitzers

Jet Aircraft of World War 11

Despite the jet's obvious speed advantages, several were engaged and shot down by Allied piston-engined fighters. Here a Messerschmitt Me 262 is caught by the camera-gun of a USAAF P-51 Mustang.

Whilst piston-engined aircraft fought out World War II, aircraft and engine designers were hard at work to harness the new jet and rocket propulsion and to perfect its use for fighting aircraft. The results of their labours were varied, but the technological advances were great.

Although combat by jet-propelled aircraft during World War II was limited to the final year of the conflict, and then undertaken only by German (and to a much lesser extent British) aircraft, the knowledge that jet reaction was potentially the most efficient of all aircraft propulsion systems had existed for some 15 years beforehand. In Germany exploitation of this knowledge had shown greatest promise, through the efforts of F.W. Sander and Fritz von Opel with solid-fuel rocket power, Paul Schmidt with pulse jets and Dr Hans von Ohain with the gas turbine, all of whom had either achieved limited jet reaction-powered flight or were on the threshold of doing so when war broke out in September 1939. In the UK work had progressed under the leadership of Frank Whittle, with no more than very little commercial support, but elsewhere in the world there was scarcely any interest in jet propulsion.

Germany was the first to fly an air-breathing jet aircraft, the Heinkel He 178, which took to the air under its own power for the first time on 27 August 1939. Next to fly a 'jet' was Italy with its crude ducted fan-jet Caproni-Campini N1 which flew in August 1940. While the Italian effort proved to be dead-ended, the Germans moved steadily forward towards operational realism as other manufacturers were encouraged into the jet propulsion field by the development of viable powerplants produced notably by Heinkel and Junkers.

Meanwhile in the UK Frank Whittle, with slowly increasing practical assistance and eventual opportunist domination by Rolls-Royce, Rover, de Havilland and others, succeeded in producing a gas turbine which, as the Power Jets W.1, first flew in the Gloster E.28/39 in May 1941. But the two-year lead gained by Germany proved unassailable and, despite the demise of the Heinkel He 280 as a potential combat aircraft, enabled the Luftwaffe to achieve operational status with its Messerschmitt Me 262 during the summer of 1944, narrowly pre-dating the first RAF Gloster Meteors. Moreover the rocket-powered Me 163 proved to be the fastest of any combat aircraft produced during the war.

The build-up of German Me 262s (as well as He 162s and Arado Ar 234s) far outstripped the somewhat tentative introduction of the British Meteor, all reliance on operational jet engine development being placed on the Rolls-Royce Welland (a direct development of the Whittle engine). The USA, on the other hand, scarcely achieved any progress in the field until in 1941 Whittle technology was provided by the UK, only managing to fly the Bell P-59 Airacomet and Lockheed P-80 Shooting Star, neither of which reached operational status before the war's end.

Japan, like Germany, frantically sought to combat the growing menace to its homeland from the USA's air onslaught and received technical assistance from Germany. It managed to fly a twin-jet fighter, the Nakajima Kikka (modelled on the Me 262), before the end of the war and also the rocket-powered Yokosuka Ohka suicide aircraft.

Nevertheless, despite growing awareness in the UK and USA of the enormous potential of the jet engine, the Allies were astounded to discover the advances made by Germany when they came to examine the spoils of war in 1945. Much of the technology had already disappeared eastwards, however, and here, much underestimated by the Western Allies, the wartime momentum gained by the Soviet Union was able to accommodate the great technical strides into its post-war plans for world military superiority.

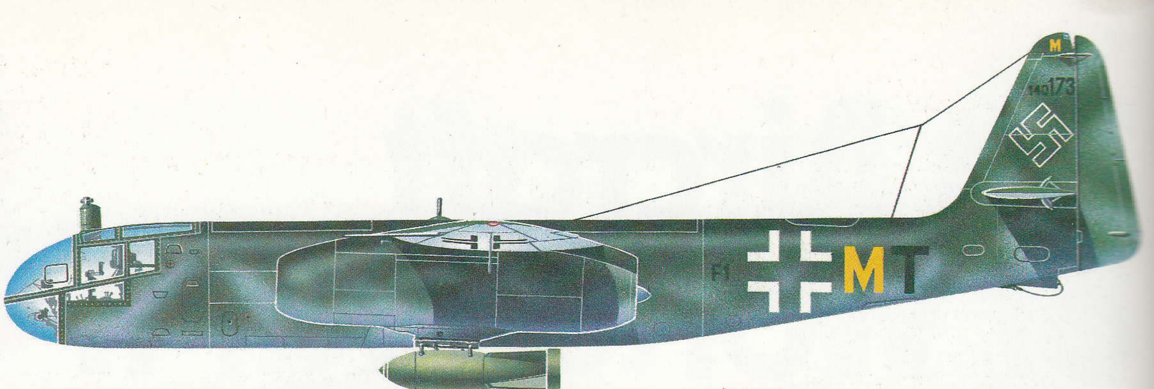
A rare colour picture of an early Gloster Meteor Mk I carrying the personal codes of Group Captain H. J. Wilson, commander of the RAF High Speed Flight, who later went on to capture the world absolute speed record in a modified Meteor in November 1945.

GERMANY

Arado Ar 234

The world's first turbojet-powered bomber, the **Arado Ar 234 Blitz** (lightning) was originally conceived as a twin-jet high-speed reconnaissance aircraft late in 1940. Delayed by slow delivery of the Junkers 004B, the **Ar 234 V1** prototype was not first flown until 15 June 1943; this aircraft featured an auxiliary trolley, which was jettisoned on take-off, in place of conventional landing gear. Further prototypes followed, including the **Ar 234 V6** and **Ar 234 V8** which were powered by four 800-kg (1,764-lb) thrust BMW 003A-1 turbojets.

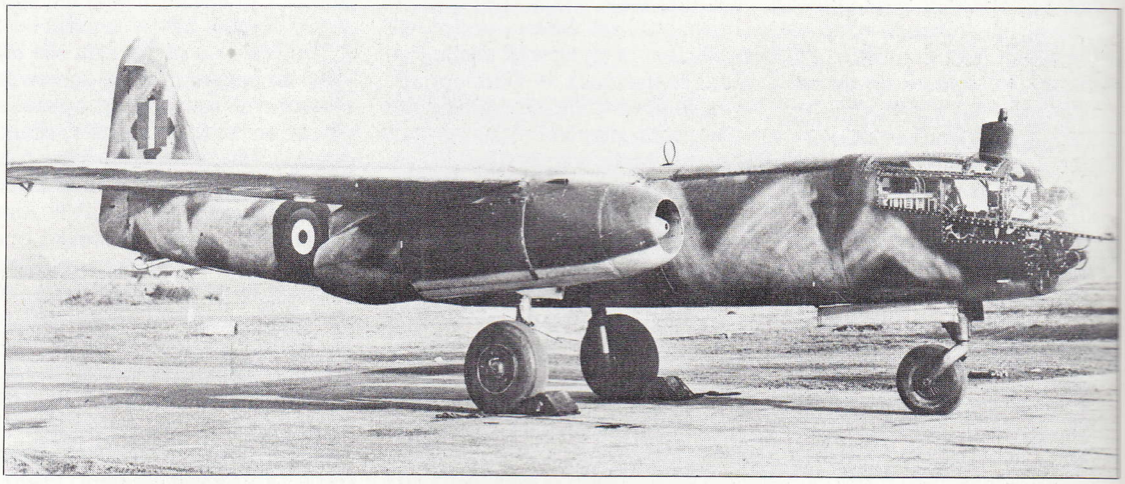
When production finally started, it was of the twin-jet **Ar 234B** which featured conventional nosewheel landing gear, the mainwheels retracting into a slightly widened centre fuselage. The **Ar 234B-1** was an unarmed reconnaissance aircraft which first served with 1 Versuchsverband Oberbefehlshaber der Luftwaffe late in 1944, and soon after with Sonderkommando Hecht and Sperling. These units were replaced in 1945 by 1 (F) 33, 1 (F) 100 and 1 (F) 123, and many reconnaissance sorties were flown over the UK. The bomber version was the **Ar 234B-2**, which could carry a bombload of 2000 kg (4,409 lb), and other variants included the **Ar 234B-2/b** reconnaissance aircraft, the **Ar 234B-2/1** pathfinder and **Ar 234B-2/r** long-range bomber. Ar 234B-2 bombers joined KG 76 in January 1945 and carried out a number of daring and hazardous raids before the end of the war. A small number of Ar 234s was also employed as night-fighters with Kommando Bonow, but the four-jet **Ar 234C**, although just beginning to appear at the end of the war, failed to reach squadron service. Many other advanced projects were in hand when hostilities ceased.



Able to carry a bombload of 2000 kg (4,409 lb), the Arado Ar 234B-2 went into service with KG 76 in January 1945. Based at Rheine and Achmer, these made many accurate strikes.

Specification
Ar 234B-2
Type: single-seat tactical light bomber
Powerplant: two 800-kg (1,764-lb) thrust BMW 003A-1 turbojets
Performance: maximum speed 742 km/h (461 mph) at 6000 m (19,685 ft); climb to 6000 m (19,685 ft) in 12.8 minutes' service ceiling 10000 m (32,810 ft); range 1630 km (1,013 miles)
Weights: empty 5200 kg (11,464 lb); maximum take-off 9800 kg (21,605 lb)
Dimensions: span 14.44 m (46 ft 3½ in); length 12.64 m (41 ft 5½ in); height 4.29 m (14 ft 1½ in); wing area 27.3 m (284.17 sq ft)
Armament: bombload of up to 2000 kg (4,409 lb); some aircraft carried two rear-firing 20-mm guns

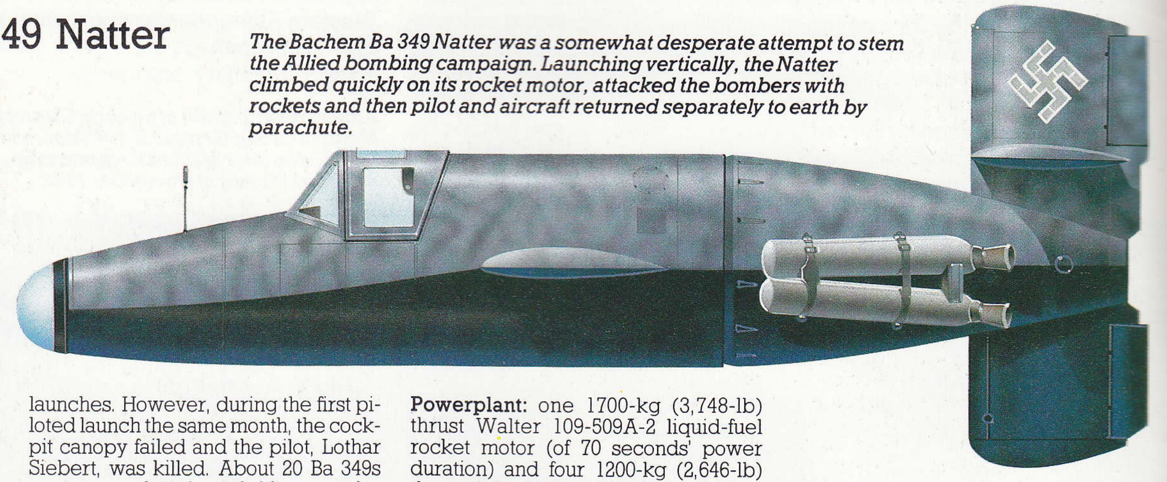
The Ar 234B proved of immense interest to the Allies and intact examples underwent rigorous testing in Britain and America. This is an Ar 234B-1 reconnaissance version, with no hardpoints.



GERMANY

Bachem Ba 349 Natter

The Bachem Ba 349 Natter was a somewhat desperate attempt to stem the Allied bombing campaign. Launching vertically, the Natter climbed quickly on its rocket motor, attacked the bombers with rockets and then pilot and aircraft returned separately to earth by parachute.



Among the ingenious expedients borne of desperation in Germany at the end of the war was the **Bachem Ba 349 Natter** (viper), a semi-expendable, vertically-launched, piloted missile. Designed under the leadership of Erich Bachem, the small aircraft was constructed mainly of bonded and screwed wooden components, and was powered by an internal Walter 109-509A-2 liquid fuel rocket (of the same type as in the Messerschmitt Me 163); for take-off boost four solid fuel Schmidding rockets provided a total thrust of 4800 kg (10,582 lb) for 10 seconds before being jettisoned. It was intended to launch the Natter on approach of Allied bombers, the pilot selecting his target and then launching his weapon load of 24 7.3-cm (2.87-in) Föhn unguided rockets. He would then jettison the nose section of the aircraft and deploy his own parachute. The remainder of the aircraft would also descend by parachute for recovery and re-use. Gliding trials started in October 1944, followed in February 1945 by the first unmanned vertical launches. However, during the first piloted launch the same month, the cockpit canopy failed and the pilot, Lothar Siebert, was killed. About 20 Ba 349s were completed, and 10 were deployed at Kirchheim, but before any Allied bombers could be intercepted the sites were overrun by advancing American forces.

Specification
Type: single-seat expendable interceptor
Powerplant: one 1700-kg (3,748-lb) thrust Walter 109-509A-2 liquid-fuel rocket motor (of 70 seconds' power duration) and four 1200-kg (2,646-lb) thrust Schmidding 109-533 solid-fuel jettisonable booster rockets (of 10 seconds' power duration)
Performance: maximum speed 800 km/h (497 mph) at sea level; initial climb rate 11140 m (36,550 ft) per minute; service ceiling 14000 m (45,930 ft); radius of action 40 km (24.8 miles)
Weight: loaded at launch 2200 kg (4,850 lb)
Dimensions: span 3.60 m (11 ft 9¾ in); length 6.10 m (20 ft 0 in); wing area 2.75 m^2 (29.6 sq ft)
Armament: 24 Föhn 7.3-cm (2.87-in) unguided rocket projectiles in nose

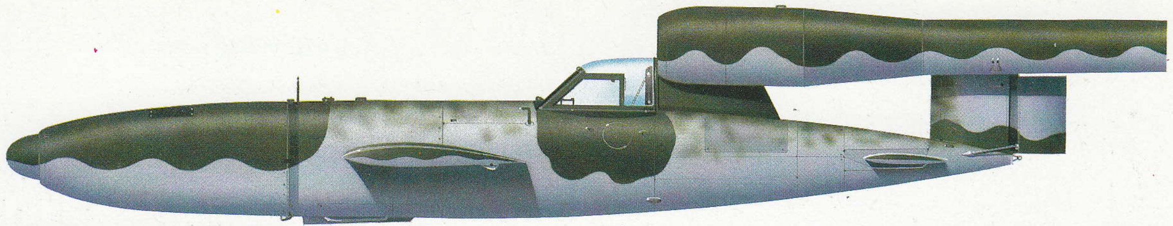
GERMANY

Fieseler Fi 103R

One of the many macabre projects being studied as Germany approached defeat at the end of the war involved the use of the **Fieseler Fi 103R,** a manned version of the Argus pulsejet-powered Fieseler Fi 103 flying bomb. Mass production of these weapons had been achieved by mid-1944 for the campaign against southern England when proposals were made to launch a manned bomb from beneath a carrier aircraft. The intention was that, after release, the flying bomb would be piloted towards a target and put into a dive before the pilot baled out at the last moment. Pilot survival was rated as being most unlikely as a result of the canopy fouling the pulsejet inlet immediately aft of the cockpit, yet the Germans steadfastly claimed a subtle distinction between their *Selbstopfermänner* (self-sacrifice men)

Fieseler Fi 103R (continued)

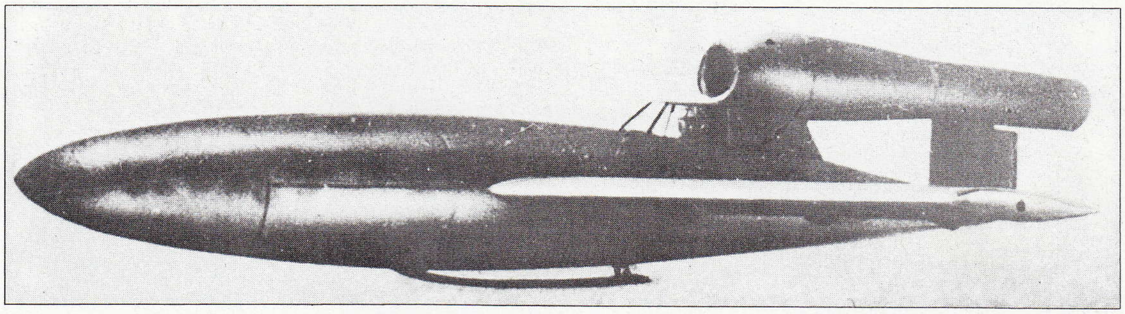
and the Japanese *Kamikaze* pilots who were sealed into their cockpits before take-off. A total of about 175 piloted Fi 103Rs (*Reichenberg* being the operational codename covering the project) were completed: the **R-I**, **R-II** and **R-III** were test and training versions, and the **R-IV** was intended for operational use. Testing was undertaken by Rechlin pilots but after two had crashed development flying was taken over by DFS test pilots Hanna Reitsch and Heinz Kensche. Handling in the air was fairly straightforward but landing was extremely tricky owing to the rudimentary control provided and the very high landing speed. Although some 70 volunteer pilots were selected for training the plan came to naught simply owing to the German high command's refusal to take the Reichenberg project seriously.



Fieseler Fi 103R Reichenberg IV.

Specification
Fi 103R-IV

Type: single-seat flying bomb
Powerplant: one 350-kg (772-lb) thrust Argus 109-014 pulsejet
Performance: maximum powered level speed 650 km/h (404 mph) at sea level; endurance (limited by pulsejet life) 20 minutes
Weight: at launch 2180 kg (4,806 lb)
Dimensions: span 5.715 m (18 ft 9 in); length 8.00 m (26 ft 3 in); maximum fuselage diameter 0.838 m (2 ft 9 in)
Warhead: 850 kg (1,874 lb)

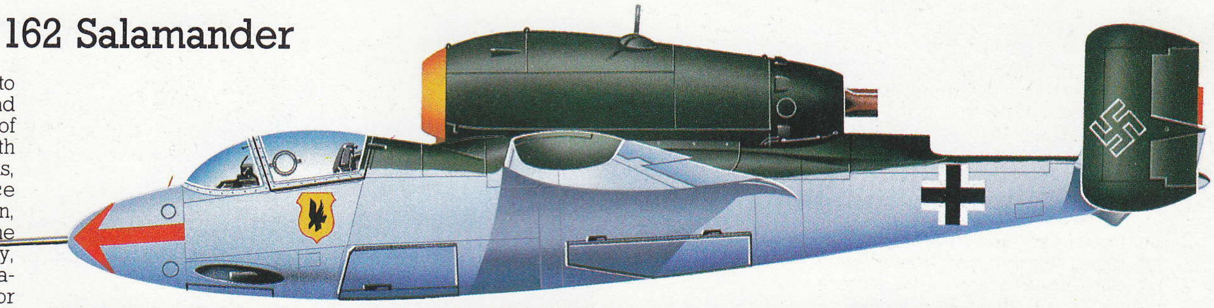


The Fi 103 (V1) is well known in its unpiloted form, but the piloted version, the* Reichenberg, *was more obscure. Intended for accurate attacks against shipping, the pilot was supposed to bale out after he had aimed at the target. In practice this would have been unlikely.

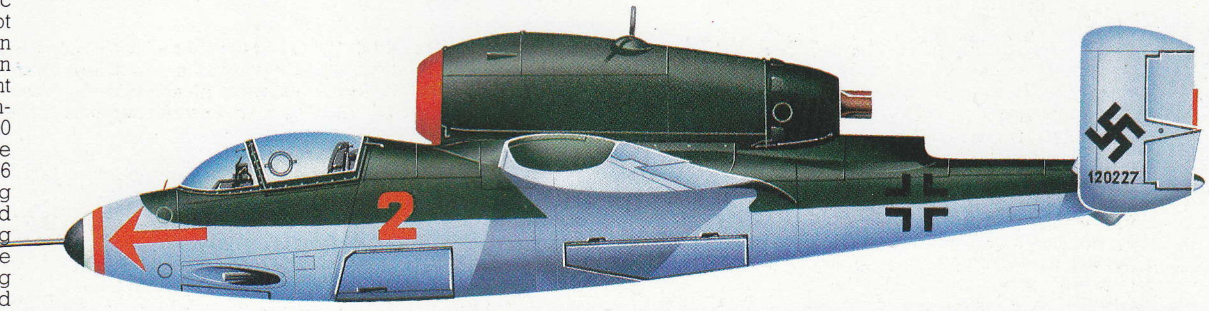
GERMANY

Heinkel He 162 Salamander

Despite all that Germany could do to press the Messerschmitt Me 163 and Me 262 into service in the latter half of 1944, it became all too clear that both aircraft demanded production skills, materials and flying experience beyond the resources of the nation, and thus were inadequate to stem the tide of Allied air attack. Accordingly, as the RLM underwent its final reorganization, proposals were studied for the mass production of a relatively simple, lightweight jet interceptor which demanded the minimum of strategic materials, engineering skill and pilot training. Within five weeks the design of the **Heinkel He 162** had been accepted and dozens of component subcontracts organized, it being intended to reach a production of 2,000 aircraft per month by May 1945. The first prototype He 162 was flown on 6 December 1944, but by the following month severe lateral instability had been disclosed, resulting in the wing tips being sharply angled down. The aircraft was a small shoulder-wing monoplane with the turbojet mounted on top of the fuselage amidships, nose-wheel landing gear and twin fins and rudders. In February a score of further prototypes flew, together with the first production examples. The first operational unit, I/JG 1, under Oberst Herbert Ihlefeldt, flew **He 162A-1** production aircraft at Parchim but, despite a prodigious effort and the completion of some 275 aircraft, the swift advance by the Allied armies prevented the little fighter from taking any significant part in the air fighting at the end of the war.

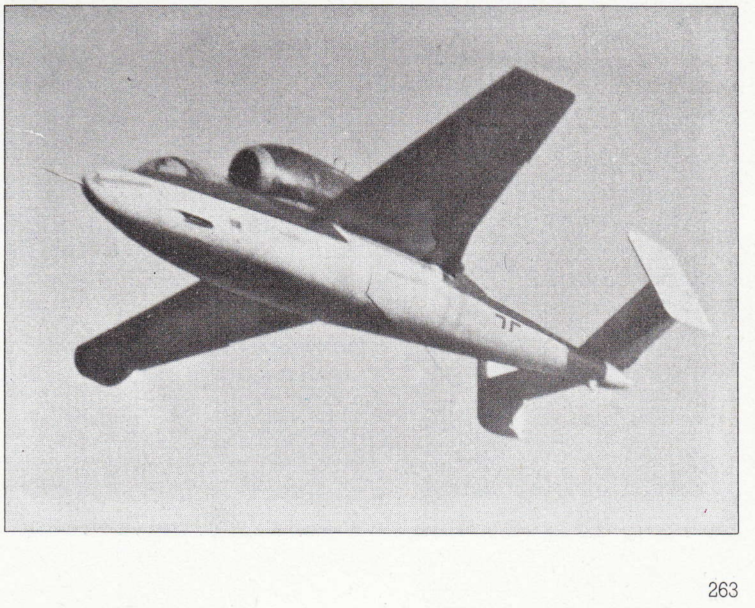


Despite its hurried development, the ingenious Heinkel He 162 would have proved an effective fighter in experienced hands, but there was insufficient time to train men of the calibre required by the Luftwaffe.



Above: Several Heinkel He 162s were captured by the Allies and extensively tested after the war. This He 162A-2 was serving with II Gruppe, Jagdgeschwader 1 at Leck when it was captured on 8 May 1945. It has since been restored and is on display at RAF St Athan.

Specification
Type: single-seat interceptor fighter
Powerplant: one 800-kg (1,764-lb) thrust BMW 109-003E turbojet
Performance: maximum speed 835 km/h (519 mph) at 6000 m (19,685 ft); initial climb rate 1290 m (4,230 ft) per minute; service ceiling about 11000 m (36,090 ft); maximum range 1000 km (621 miles)
Weights: empty 1750 kg (3,858 lb); maximum take-off 2700 kg (5,952 lb)
Dimensions: span 7.20 m (23 ft 7½ in); length 9.05 m (29 ft 8½ in); height 2.55 m (8 ft 4⅜ in); wing area 11.15 m^2 (120.0 sq ft)
Armament: two 30-mm MK 108 or two 20-mm MG 151 cannon in nose



Right: The He 162 suffered from all the symptoms of 1945 Germany – lack of fuel, poor materials, inexperienced workmen and pilots, and hasty design and development. Attempts to overcome these problems were swamped by the Allied advance.

German Advanced Designs

The German aircraft designers were never constricted by conformity, and nowhere was this more apparent than in their jet and rocket designs. Some were successful, most failed but their research and innovation proved of immense help to the Allies after the war.

In the sharpest possible contrast with the Allies, who had superb jet engines but failed to produce the jet aircraft, Hitler's Germany provided an environment in which, despite the most desperate technical difficulties and shortages, aircraft designers seemed to vie with each other to draw futuristic shapes and, if possible, turn them into metal. In 1945 a famed British fighter designer looked at some of these designs and laughed them to scorn. 'They're not to be taken seriously,' he said, 'and anyway we've won the war.' He was certainly wrong to adopt such a posture, because before long such silly futuristic designs as the Mikoyan-Gurevich MiG-15 and North American F-86 Sabre had pushed the UK into the second aeronautical rank. At the same time, the designer had a point. Few of the amazing German projects accomplished anything towards staving off defeat, and there were certainly too many of them to be capable of realization by a country which could not even train pilots for its existing aircraft.

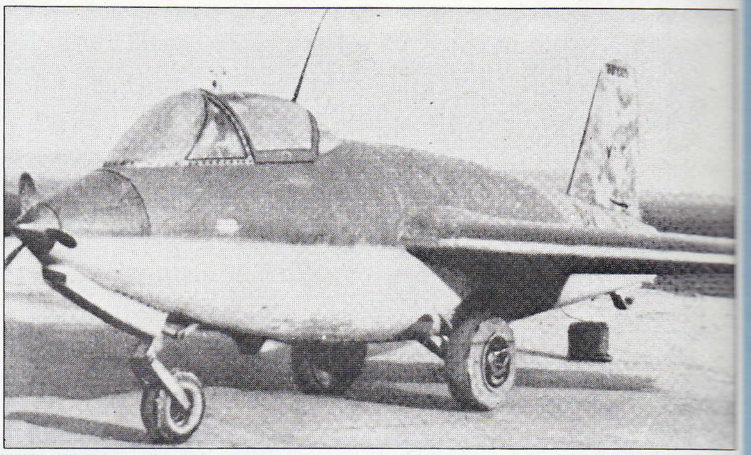
One of the futuristic German jets saw action in numbers: the superb Messerschmitt Me 262. Another got into action even earlier, but this, the tailless Messerschmitt Me 163B rocket interceptor, was much more dangerous to its pilots than to its enemies. This was because, foolishly, it had been designed to take off from a jettisonable dolly and alight on a sprung skid. This arrangement gave much trouble, and anything that shook up the highly reactive rocket propellants tended to cause the Me 163B to go up in a fireball. Despite this, in normal flight the strange little interceptor was a joy to fly, and its fast and steep climb, great agility and two 30-mm guns made it a very difficult opponent during its missions against the USAAF heavy bombers.

Large-scale service

Only one other German jet got into large-scale service: the Arado Ar 234B-2. Called the Blitz (lightning), this was designed as a high-wing twin-jet, using the same Jumo 004B engines as the Me 262. Rather larger than the Me 262, it was designed as a reconnaissance aircraft but soon gained racks for a substantial (1500-kg/3,307-lb) bombload beneath the slim fuselage and underslung engine nacelles. Like many other German jet projects the Ar 234 began by having a take-off dolly and landing skid, but the Ar 234B-2 production version had a proper landing gear, all three units retracting into the fuselage which also housed the pressurized single-seat cockpit in the extreme nose, 3750 litres (825 Imp gal) of diesel oil fuel and two MG 151 20-mm cannon firing directly to the rear and aimed by a periscope.

This extremely useful aircraft entered service in September 1944 in a special unit *(Sonderkommando)* set up for the purpose at Rheine/Hopsten, and by the end of the year more than 1,000 photo-reconnaissance sorties had been flown at a height of 10000 m (32,810 ft). The photo coverage was superb, and utterly transformed the previous almost non-existent reconnaissance capability of the Luftwaffe over northern Italy and even over southern England. (What a difference this aircraft would have made to the German high command in the build-up to the D-Day invasion on 6 June 1944.) Though its engines were as tricky and unresponsive as in the Me 262, the Ar 234 suffered no worse than normal attrition in its first months in service, and only one was lost in action in 1944. None was shot down by Allied aircraft until 24 February 1945, when an Ar 234B-2 flying on one engine was forced down near Segelsdorf and captured a day later almost undamaged. As a bomber the Ar 234 suffered from the need for a very long take-off run, though booster rockets were often used. The narrow track and high tyre loading caused occasional accidents, but in the air the maximum load could be handled with ease. The Arados reached their high point with their prolonged attacks on the big Remagen bridge across the Rhine, and their 1000-kg (2,205-lb) bombs dropped from low level in shallow dive attacks finally brought the bridge down after 10 days on 17 March 1945. But by then the Allied armies were well into Germany.

About 60 of the 210 Arados delivered were captured in flying condition, and most Allied countries had a whole squadron of them in mid-1945. Apart from the critical nature of some take-offs, the Ar 234 was found to be a fine aircraft, with no severe Mach trouble up to 0.8 and a range in clean condition of well over 1610 km (1,000 miles).



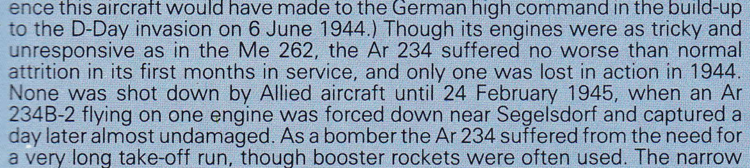
One of the shortcomings of the Me 163 was the dolly undercarriage, which was jettisoned on take-off, the aircraft landing on a skid. The Me 163D was developed with retractable tricycle undercarriage, leading to the Me 263 V1 (illustrated). The aircraft was briefly known as the Junkers Ju 248 V1.

There was one other German jet which was produced in numbers, and this was one of the most remarkable examples of a last-ditch effort in the history of warfare. By mid-1944 virtually all piston-engine bomber flying by the Luftwaffe had stopped through shortage of fuel, and from July 1944 production of aircraft other than fighters was drastically curtailed or halted. The need for fighters to stave off the vast armadas of Allied aircraft became ever more acute, and after much prior discussion the air ministry technical office issued an unprecedented demand on 8 September 1944 calling for a totally new fighter to defend the Reich. It had to be simple, cheap, capable of being built in vast quantities by unskilled labour, capable of being piloted by inexperienced pilots (even Hitler Youth members were suggested) and, not least, the designs had to be submitted 12 days later, so that mass-production could begin on 1 January 1945!

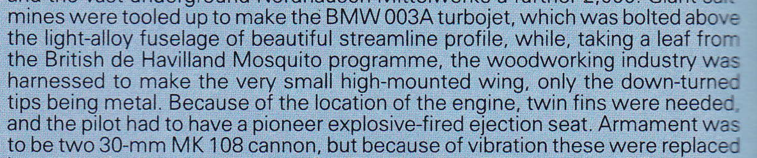
Volksjäger

The result was the Heinkel He 162 Salamander, popularly called the Volksjäger (people's fighter). Not only was it, in the circumstances, a very impressive engineering design, but the parallel plans for its manufacture sound in the 1980s like something out of fiction. Today a fighter output of one a week is quite good in Western countries, but the production rate for the He 162 was to be 135 per day; Rostock-Marienehe and Bernburg were each to deliver 1,000 per month and the vast underground Nordhausen Mittelwerke a further 2,000. Giant saltmines were tooled up to make the BMW 003A turbojet, which was bolted above the light-alloy fuselage of beautiful streamline profile, while, taking a leaf from the British de Havilland Mosquito programme, the woodworking industry was harnessed to make the very small high-mounted wing, only the down-turned tips being metal. Because of the location of the engine, twin fins were needed, and the pilot had to have a pioneer explosive-fired ejection seat. Armament was to be two 30-mm MK 108 cannon, but because of vibration these were replaced in production by two 20-mm MG 151s. The first flight came on 6 December 1944, but defective wood bonding caused two structural failures, the second one (loss of a wing leading edge) proving fatal. There were urgent modifications, better quality control of bonded joints, and the vast production programme swung into action. By the final collapse something in excess of 270 had flown and 800 more were about to fly, but the first unit, JG 1, never quite got into action.

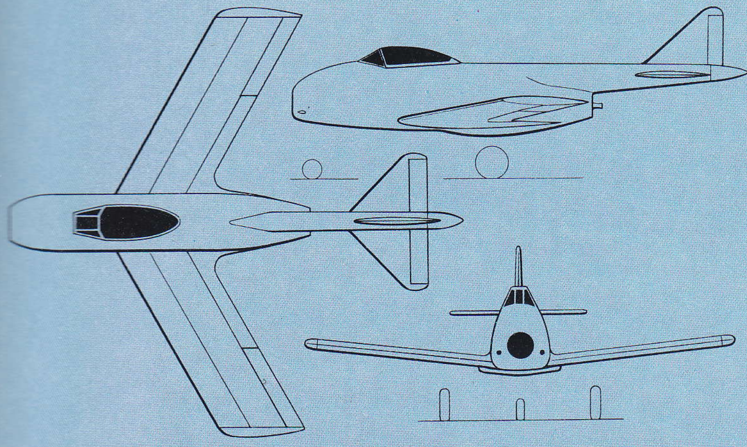
There were numerous advanced derivatives of the He 162A-2 production model, some having swept-back or swept-forward wings and others one or two flying-bomb type pulsejet engines. Messerschmitt even designed an aircraft



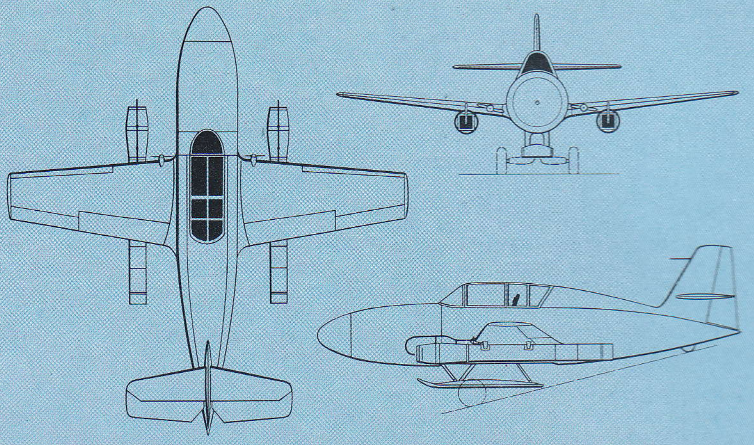
Development of the Heinkel He 162 led to the He 162C, with wing swept at 38 degrees and a butterfly tail. The He 162D was similar but featured a swept-forward wing. Neither version was built, but a model was found under construction with interchangeable wings when Schwechat was occupied by the Allies.



The Arado Ar 234 had many interesting developments planned, including the V16 with crescent wing. One which reached flying status was the Ar 234C four-engine version, of which several were built. This example is the Ar 234 V13, with four BMW 003A-1 turbojets mounted on a B-series airframe.



Designed for the Volksjäger (People's Fighter) concept, the Blohm und Voss P.211 was a basically sound design. Power was to be provided by one BMW 003A turbojet, and estimated speeds were 475 mph (464 km/h) at sea level and 536 mph (863 km/h) at 26,000 ft (7925 m). Due to political wrangles, the Heinkel He 162 design was chosen.



Powered by two Argus pulse jets, the Messerschmitt Me 328B-1 was designed as a fighter-bomber armed with two 20-mm cannon and 1000 kg (2,205 lb) external load. The Me 328 started life as an escort fighter to be towed behind an He 177 or Me 264 bomber and as such the prototype underwent extensive gliding trials.

from scratch to be powered by these throbbing and vibrating units, whose fault was that they needed an inlet airflow to get them started (apart from the terrible vibration) but whose appeal was cheap mass production. The twin-pulsejet Me 328B was a single-seat attack bomber, made almost entirely of wood and able to carry an underslung 1000-kg (2,205-lb) bomb, which reduced the speed at low level from 700 to 530 km/h (435 to 329 mph). As with most of these desperate projects there was a host of derived versions including fighters to be catapulted from U-boats and *kamikaze* glider-bomb versions released from ordinary bombers.

Striking innovations

Visually the most striking of the German jets actually built was the Horten Ho IX (built by Gotha who took over the programme as the Go 229A), though this was captured within weeks of its first flight. Powered by two Jumo 004B turbojets, the Ho IX was a flying wing of extremely clean design with no tail of any kind and no projection whatsoever except for the neatly faired cockpit canopy and the slightly projecting jet nozzles. With a span of 16.76 m (55 ft), it was only 7.46 m (24 ft 5¾ in) long and was expected to fly at between 950 and 975 km/h (590 and 606 mph) at all heights when carrying four 30-mm cannon. At reduced speed it was to carry two 1000-kg (2,205-lb) bombs, which would have made this seemingly very efficient aircraft a formidable bomber, if a way could have been found to aim them accurately. Another variant was the Go 229B radar-equipped night-fighter.

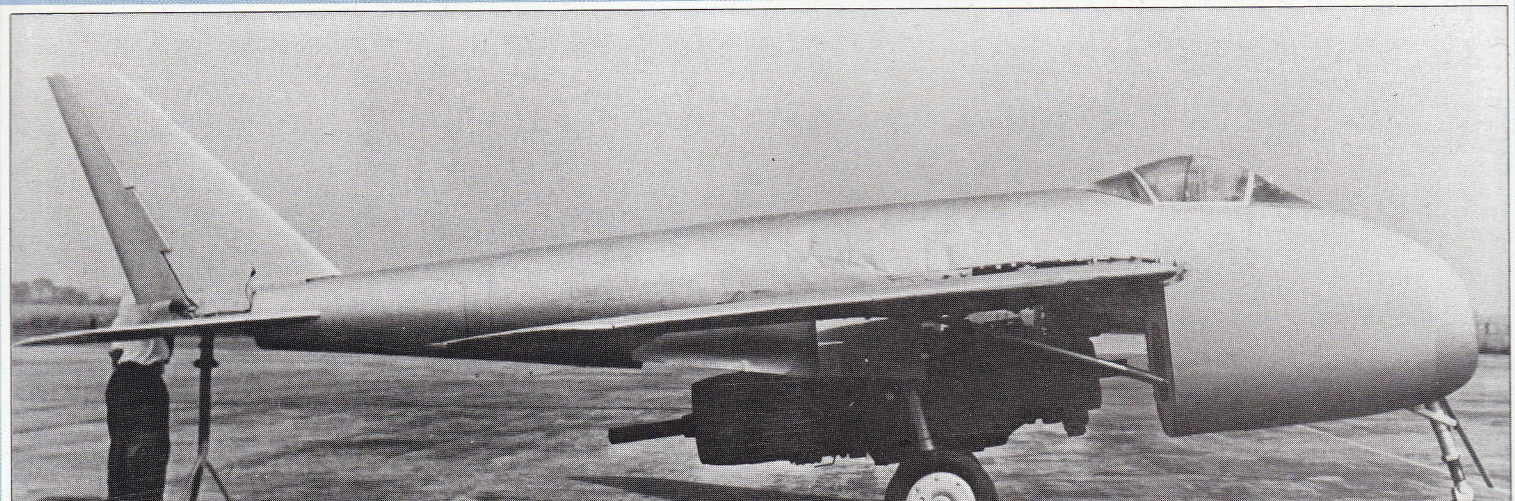
Another prototype that was captured within days of its first flight was an extremely small attack bomber, the Henschel Hs 132. Superficially this resembled the He 162A fighter in having a slim streamlined metal fuselage, wooden wing and dorsal BMW 003A engine exhausting between two fins. In fact, the Hs 132 was conceived purely as a dive-bomer, carrying a 500-kg or possibly 1000-kg (1,102-lb or possibly 2,205-lb) bomb, aimed by diving steeply and then pulling out at about 10 g, the pilot being able to withstand this by lying prone in the nose. An earlier research aircraft, the Berlin B 9, had shown how prone cockpits not only resisted g better but also reduced frontal area.

Swept-forward wing

In a different class, the big Ju 287 bomber actually got into the air, though only in the form of an interim prototype lashed together by using parts of other aircraft, including the tail of a Ju 388 and nosewheels from two shot-down Consolidated B-24 Liberators. This big four-jet machine was the first aircraft ever built with wings swept forward to delay compressibility problems (as is now being done again 40 years later with the Grumman X-29A). It was also unusual in having two of the 004B engines hung under the wings and the other two on the sides of the fuselage, though unlike the fuselage-mounted jets of today's jetliners they were at the front.

Other advanced designs were legion. Blohm und Voss was one of three builders who proposed wings swept both fore and aft in W or M configuration (as proposed in 1962 for Mach 1.2 jetliners), while Messerschmitt pioneered the variable-geometry swing-wing with the P.1101 which might have flown in May 1945. The P.1101 was taken to the USA where it formed the basis for the Bell X-5, the world's first variable-geometry aircraft, flown in June 1951. Even more striking in appearance was the amazing little Lippisch DM-1 glider, the first high-speed delta and intended to lead to the 1,650-km/h (1,025-mph) LP-13a ramjet fighter.

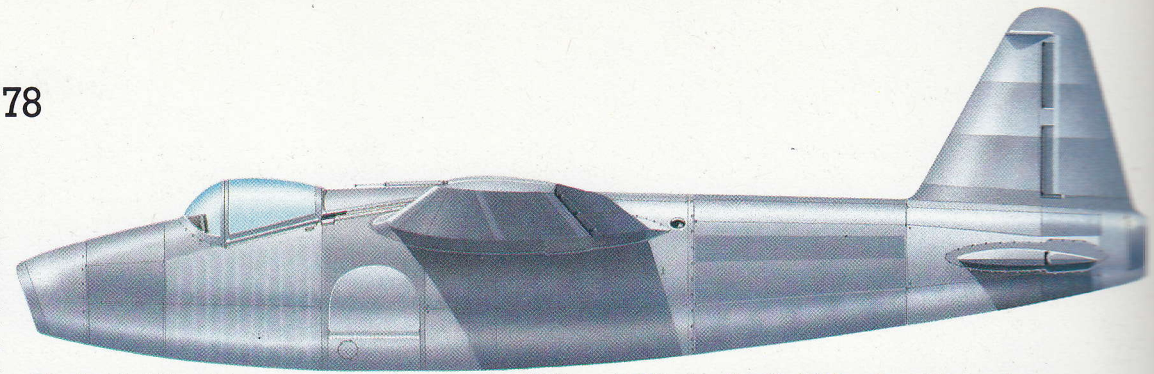
One of the most interesting and progressive of German jet designs, the Messerschmitt P.1101 was the first aircraft to employ variable sweep to gain low and high speed flying qualities. This picture of the P.1101 shows it with cowling removed and a mock-up jet engine.



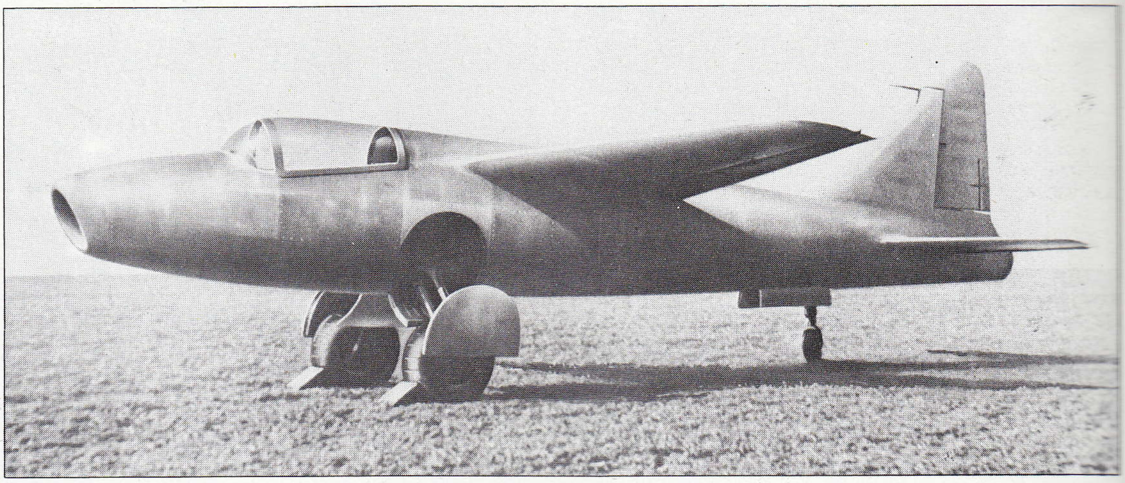
GERMANY

Heinkel He 178

The world's first aircraft to fly solely powered by a turbojet was the German **Heinkel He 178**, which was flown by Flugkapitän Erich Warsitz at Marienehe on 27 August 1939, one week before the outbreak of World War II. The first step in the development of this aeroplane was taken in March 1936 when Ernst Heinkel engaged the services of the German gas turbine pioneer Dr Hans Pabst von Ohain and his assistant Max Hahn. The first demonstration turbojet, the HeS 1, was bench running by September 1937, and a development of this engine, the HeS 3, was flight tested suspended beneath a Heinkel He 118 in 1938. By 1939, it had been decided to instal a new version, the HeS 3b, in a special aircraft, the He 178, which commenced building that year; it was a shoulder-wing aircraft with wings made largely of wood but with a semi-monocoque metal fuselage. Tailwheel landing gear was incorporated, and the engine drew its air from an inlet in the nose and exhausted through a long jet pipe which extended to the extreme tail. The 178 was damaged on its first flight when the engine ingested a bird which caused it to flame out, but the aircraft made a safe landing. It was later flown with a 590-kg (1,301-lb) thrust HeS 6 engine, but a number of airframe defects limited the speed to about 600 km/h (373 mph). The He 178 was later moved to the Berlin Air Museum where it was destroyed in 1943 during an Allied air raid.



The first flight by a jet-powered aircraft occurred on 27 August 1939 when this He 178 flew from Marienehe, near Rostock. Despite their superior engine, it was two years before the British matched this feat.



Only one He 178 was built, and was an extremely clean design for its day, with fully retracting and faired-in undercarriage. Maximum speed was 580 km/h (360 mph).

Specification

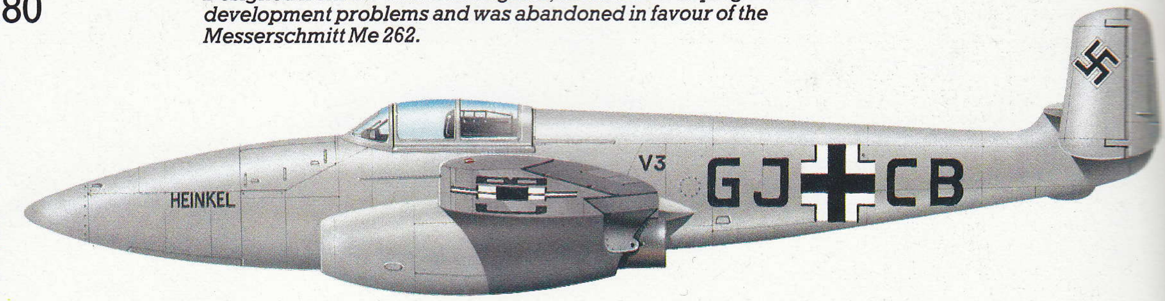
He 178 (initial powerplant)
Type: single-seat research aircraft
Powerplant: one 500-kg (1,102-lb) thrust Heinkel HeS 3b centrifugal-flow turbojet
Performance: (estimated) maximum speed 580 km/h (360 mph) at sea level; landing speed 165 km/h (103 mph)
Weights: empty 1590 kg (3,505 lb); maximum 1990 kg (4,387 lb)
Dimensions: 7.10 m (23 ft 3½ in); length 7.51 m (24 ft 6½ in); height 2.10 m (6 ft 10⅝ in); wing area 7.90 m^2 (85.04 sq ft)
Armament: none

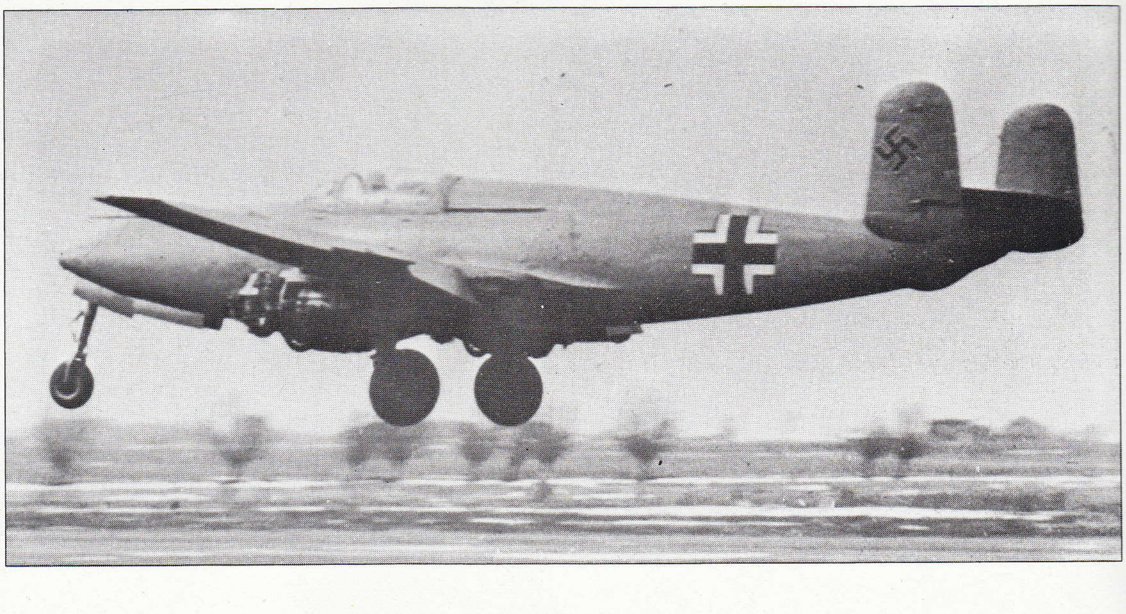
GERMANY

Heinkel He 280

The world's first turbojet aircraft designed from the outset as a potential fighter, the **Heinkel He 280** made its first flight on 2 August 1941 (19 months before the first Gloster Meteor). Design of the He 280, which started before the end of 1939, included a low wing with twin underslung turbojets, tricycle landing gear and twin fins and rudders. Desite the obvious need for low-diameter engines, Dr von Ohain succeeded in developing the centrifugal-flow HeS 8 (or 109-001) to produce 700-kg (1,543-lb) thrust, and a pair of these engines powered the **He 280 V1** on its first flight (the engines being left uncowled on this occasion). A total of nine prototypes flew, including the **He 280 V2** and **He 280 V3** with HeS 8 engines (the former also being re-engined with Jumo 109-004s), the **He 280 V4** with BMW 109-003s and later with six Argus 109-014 pulsejets, the **He 280 V5** first with HeS 8s and later with 109-003s, the **He 280 V6** (as well as the V5) with three MG 151 20-mm cannon, the **He 280 V7** with 109-004s (and later tested as a high-speed glider for aerodynamic research), the **He 280 V8** with 109-004s and a V-type tail unit, and the **He 280 V9** with 109-003s.

Designed from the outset as a fighter, the He 280 was plagued with development problems and was abandoned in favour of the Messerschmitt Me 262.





After several flights towed behind a pair of Bf 110s, the He 280V-1 made its first powered flight on 2 April 1941 and is seen here landing back at Marienehe. For this first flight the engines were kept uncovered, as during test runs fuel had gathered in the cowlings.

Although production of the He 280 was planned, recurring complaints (which included structural weakness in the tail, together with tail flutter, and inadequate fuel and armament provision) caused the design to be abandoned in favour of the Messerschmitt Me 262. It was, incidentally, from the He 280 V1 that the first-ever bale-out using an ejector seat was made when Argus test pilot Schenk abandoned the aircraft when his controls locked from icing-up.

Specification

He 280 V5

Type: single-seat prototype interceptor fighter

Powerplant: two 750-kg (1,653-lb) thrust HeS 8A (109-001A) turbojets

Performance: maximum short-burst speed 900 km/h (559 mph) at 6000 m (19,685 ft); initial climb rate 1145 m (3,755 ft) per minute; estimated service ceiling 11500 m (37,730 ft); range 650 km (404 miles)

Weights: empty 3215 kg (7,088 lb); maximum take-off 4310 kg (9,502 lb)

Dimensions: span 12.20 m (40 ft 0 in); length 10.40 m (34 ft 1½ in); height 3.06 m (10 ft 0½ in); wing area 21.50 m^2 (231.5 sq ft)

Armament: three nose-mounted 20-mm MG 151 cannon (intended later to be increased to six)

GERMANY

Henschel Hs 132

During the last half of 1943 experience showed that losses during conventional dive-bombing with the venerable Junkers Ju 87 were becoming prohibitive without heavy fighter escort, particularly in the face of ever-growing Soviet air presence on the Eastern Front. The Henschel company, with considerable experience in producing ground-support aircraft, put forward late in 1944 proposals for an essentially simple single-jet attack bomber with a BMW 109-003E-2 turbojet mounted above the fuselage. In essence the aircraft resembled the Heinkel He 162 with twin fins and rudders, although the sharply tapered wing was mounted at mid-fuselage depth; more significant, the pilot occupied a prone position in the extreme nose so as to withstand the likely 12g forces expected to accompany shallow dive recovery. Simplified construction with widespread use of wood in the structure was welcomed by the RLM and three prototypes were ordered, and commenced building in March 1945. Only the **Henschel Hs 132 V1** had been completed (but not flown) by the war's end, and all three aircraft were taken over by the Soviet forces in their advance from the east. The first aircraft was to have carried a single 500-kg (1,102-lb) bomb recessed into the underfuselage; the second, with 900-kg (1,984-lb) thrust engine combined this load with two nose-mounted 20-mm MG 151 cannon; and the third, with 1300-kg (2,866-lb) thrust Heinkel-Hirth 109-011A turbojet would carry a 1000-kg (2,205-lb) bomb, two 30-mm MK 103 and two 20-mm MG 151 guns. It was intended that the PC 1000RS Pol rocket-assisted armour-piercing bomb would be used for battlefield support attacks.

Specification

Hs 132 V1

Type: single-seat dive bomber

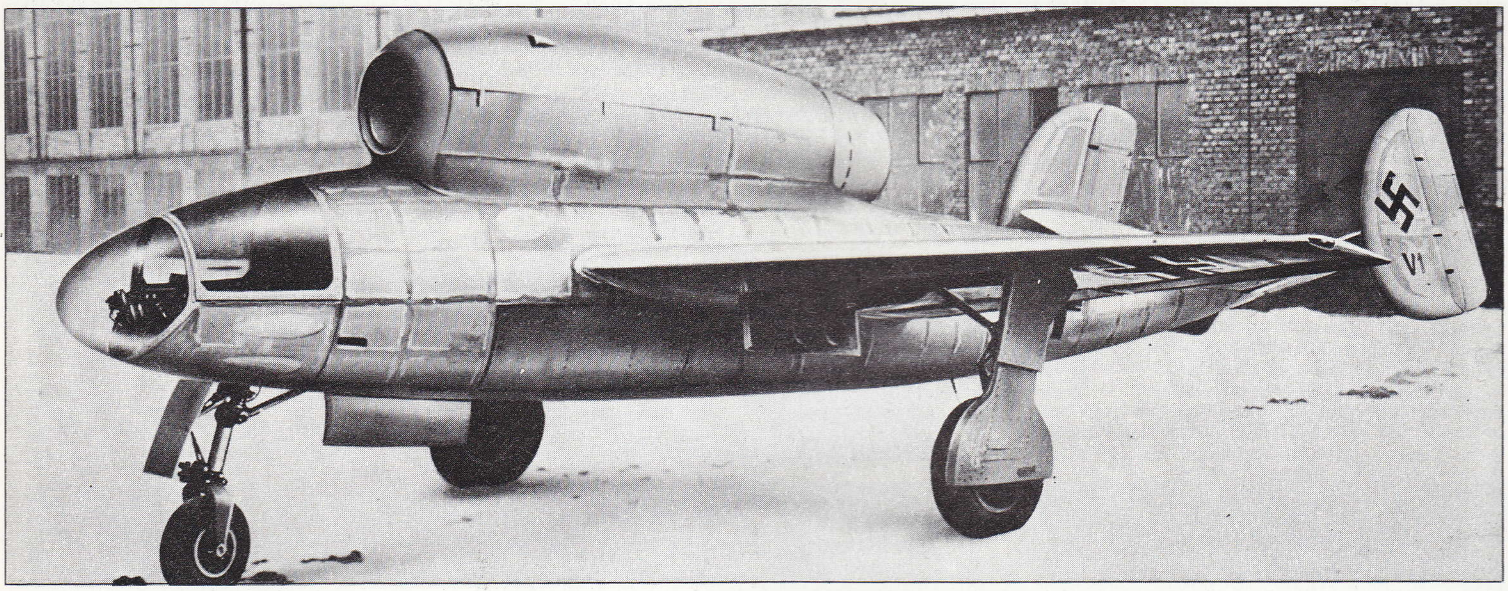
Powerplant: one 800-kg (1,764-lb) thrust BMW 109-003E-2 turbojet

Performance: maximum speed 780 km/h (485 mph) at 6000 m (19,685 ft); service ceiling 10250 m (33,630 ft); range 680 km (423 miles)

Weights: maximum take-off 3400 kg (7,496 lb)

Dimensions: span 7.20 m (23 ft 7½ in); length 8.90 m (29 ft 2½ in); wing area 14.82 m^2 (159.4 sq ft)

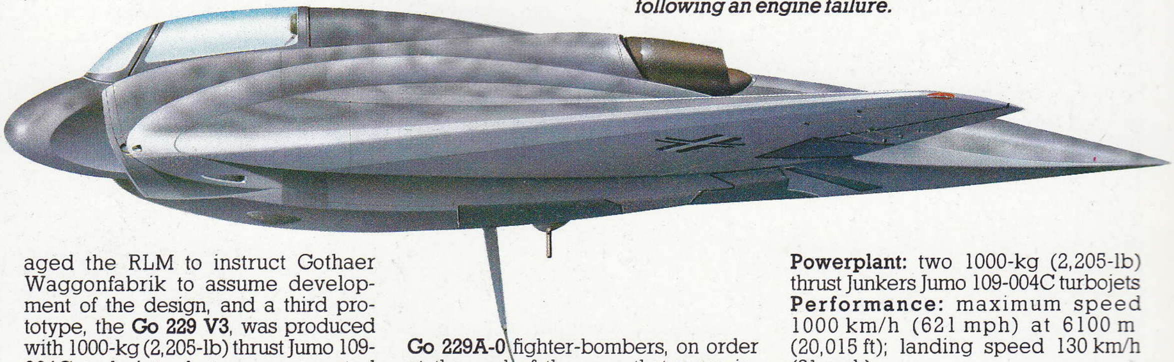
Armament: one 500 kg (1,102-lb) bomb under the fuselage



Although it never flew, the Henschel Hs 132 was a most interesting concept. With a configuration resembling the Heinkel He 162, the most striking feature of the aircraft was the prone pilot position, incorporated to enable the pilot to withstand the expected 12g when the aircraft pulled out from its dive after releasing the bomb.

GERMANY

Horton Ho IX (Gotha Go 229)



The Horten Ho IX V2 was the only aircraft of this series to achieve powered flight. Its career ended abruptly following an engine failure.

The **Horton Ho IX** twin-jet tailless fighter-bomber, of which two prototypes were flown before the end of the war, was of extremely advanced design, which benefited from considerable experience gained by the brothers Reimar and Walter Horten in the development of flying-wing aircraft, of which the majority were gliders. Designed by Sonderkommando 9, starting in 1942, the first prototype **Ho IX V1** was found to be unable to accommodate the two intended BMW 109-003-1 turbojets owing to an unforeseen increase in engine diameter, and it was therefore flown as a glider at Oranienburg during the summer of 1944. The redesigned **Ho IX V2** was fitted with two Junkers 109-004B-1 turbojets and flown successfully at Oranienburg, demonstrating speeds of up to 960 km/h (597 mph) before it was destroyed while making a single-engine landing. Such promise encouraged the RLM to instruct Gothaer Waggonfabrik to assume development of the design, and a third prototype, the **Go 229 V3**, was produced with 1000-kg (2,205-lb) thrust Jumo 109-004C turbojets, but was prevented from flying by the end of hostilities in May 1945. Work had also started on the two-seat **Go 229 V4** and **Go 229 V5** night-fighter prototypes, the **Go 229 V6** armament test prototype, and the **Go 229 V7** two-seat trainer. No progress had been made on 20 pre-production **Go 229A-0** fighter-bombers, on order at the end of the war, that were intended to carry two 1000-kg (2,205-lb) bombs and four 30-mm MK 103 cannon.

Specification

Go 229A-0

Type: single-seat fighter-bomber

Powerplant: two 1000-kg (2,205-lb) thrust Junkers Jumo 109-004C turbojets

Performance: maximum speed 1000 km/h (621 mph) at 6100 m (20,015 ft); landing speed 130 km/h (81 mph)

Weight: maximum take-off 8500 kg (18,739 lb)

Dimensions: span 16.78 m (55 ft 0⅝ in); length 7.47 m (24 ft 6⅛ in); wing area 51.5 m^2 (554.36 sq ft)

Armament: four 30-mm MK 103 cannon and up to 2000 kg (4,409 lb) of bombs

GERMANY

Junkers Ju 287

The revolutionary **Junkers Ju 287** was the outcome of development of a bomber project being studied by Dipl.Ing. Hans Wocke at Junkers in June 1943 at a time when fast bombers still enjoyed priority in Luftwaffe planning. Instead of employing a 'conventional' swept-back wing (advocated as early as 1935 by Prof. A. Busemann) Wocke suggested using a swept-forward wing in which the high-speed benefits of reduced thickness-chord would be more readily achieved, at the same time reducing low-speed instability. To speed manufacture of the prototype, the **Ju 287 V1** featured an extraordinary mixture of existing components, including the fuselage of a Heinkel He 177, Ju 388 tail unit, Ju 352 mainwheels and the nosewheels of captured Consolidated B-24 Liberators. Design of the aircraft was directed by Dipl.Ing. Ernst Zindel and, powered by four Jumo 109-004B-1 turbojets, this was flown by Flugkapitän Siegfried Holzbauer at Brandis on 16 August 1944; the prototype required take-off assistance in the form of a jettisonable Walter 109-501 rocket under each turbojet. A total of 17 flights was made before priority for jet bombers was abandoned at about this time. For some reason, never satisfactorily explained, the RLM returned to a bombing philosophy in March 1945 and ordered the Ju 287 into production. Construction of two further prototypes, the **Ju 287 V2** with six jet engines and the **Ju 287 V3** returning to four more powerful turbojets, commenced but neither was flown before the end of the war. The entire programme was then transferred to Podberezhnye in the USSR, together with many of its associated technicians, and flight trials continued there until about 1948.

Specification
Ju 287 V1

Type: prototype high-speed heavy bomber

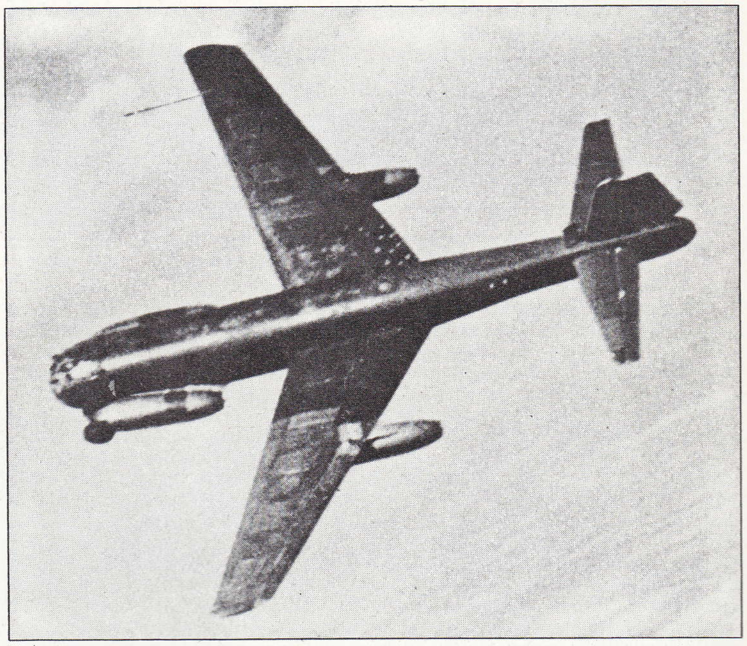
Powerplant: four 900-kg (1,984-lb) thrust Junkers Jumo 109-004B-1 turbojets

Performance: maximum speed 559 km/h (347 mph) at 6000 m (19,685 ft); service ceiling 10800 m (35,435 ft); maximum range 1500 km (930 miles)

Weights: empty 12510 kg (27,579 lb); maximum take-off 20000 kg (44,092 lb)

Dimensions: span 20.11 m (65 ft 11¾ in); length 18.30 m (60 ft 0½ in); wing area 58.30 m² (627.3 sq ft)

Armament: (V3) bombload of up to 4000 kg (8,818 lb) and gun armament in tail barbette

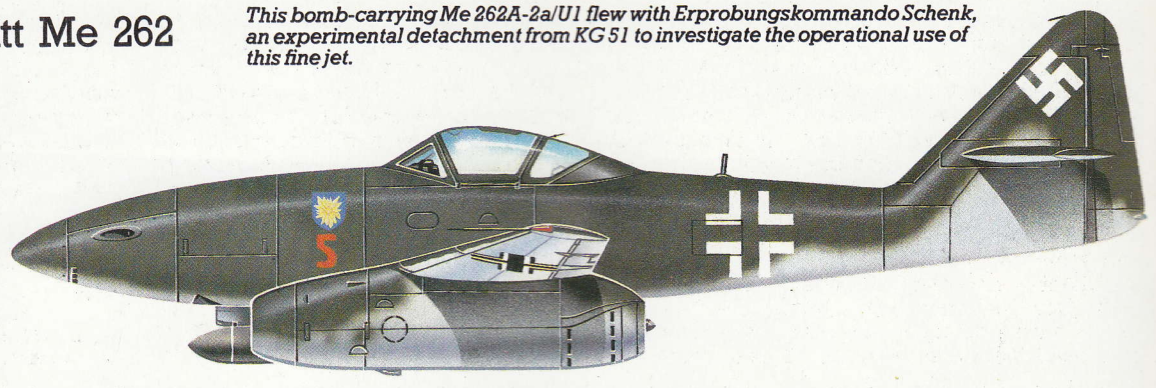


The most futuristic of all jets to fly during the war, the Ju 287V-1 was the only example built by Junkers. The second prototype was completed by the Russians after the war, flying with six engines.

GERMANY

Messerschmitt Me 262

This bomb-carrying Me 262A-2a/U1 flew with Erprobungskommando Schenk, an experimental detachment from KG 51 to investigate the operational use of this fine jet.



The **Messerschmitt Me 262** was one of the first turbojet-powered aircraft to achieve combat status, and was the result of pre-war research with gas turbines in Germany. Design of the aircraft started in 1938 and prototype airframes were ready in 1941 but, as the Junkers jet engines were not then ready, the first flight on 18 April was made using a single Jumo 210G piston engine; it was not until 18 July 1942 that the **Me 262 V3** first made an all-jet flight powered by two 840-kg (1,852-lb) thrust Junkers 109-004A-0 turbojets. Early prototypes featured tailwheel landing gear, but when production started in 1944 a tricycle arrangement had been standardized. As Hitler persisted in demanding development of the Me 262 as a bomber for reprisal raids on the UK, development of the fighter was badly delayed and it was not until late in 1944 that the aircraft entered Luftwaffe service. The **Me 262A-1a Schwalbe** (swallow) fighter was armed with four 30-mm guns in the nose and joined Kommando Nowotny in October; it was followed by the **Me 262A-1a/U1** with two additional 20-mm guns, the **Me 262A-1a/U2** bad-weather fighter and the **Me 262A-1a/U3** unarmed reconnaissance aircraft. The **Me 262A-2a Sturmvogel** (stormy petrel) bomber could carry up to 500 kg (1,102 lb) of bombs in addition to the four 30-mm guns, and a two-seat version (with prone bomb-aimer), the **Me 262A-2a/U2**, was also produced.

Before the end of the war Me 262s were being flown with some success against Allied bombers both as day and night fighters (the latter were radar-equipped **Me 262B-1a/U1** aircraft), and air-to-air rockets were being developed. Dogged by difficulties brought on by Allied raids on factories and airfields, the Luftwaffe's jet fighter units nevertheless posed a formidable threat to Allied air superiority during the last few months of the war.

Specification
Me 262A-1a

Type: single-seat interceptor fighter

Powerplant: two 900-kg (1,984-lb) thrust Junkers Jumo 109-004B-4 turbojets

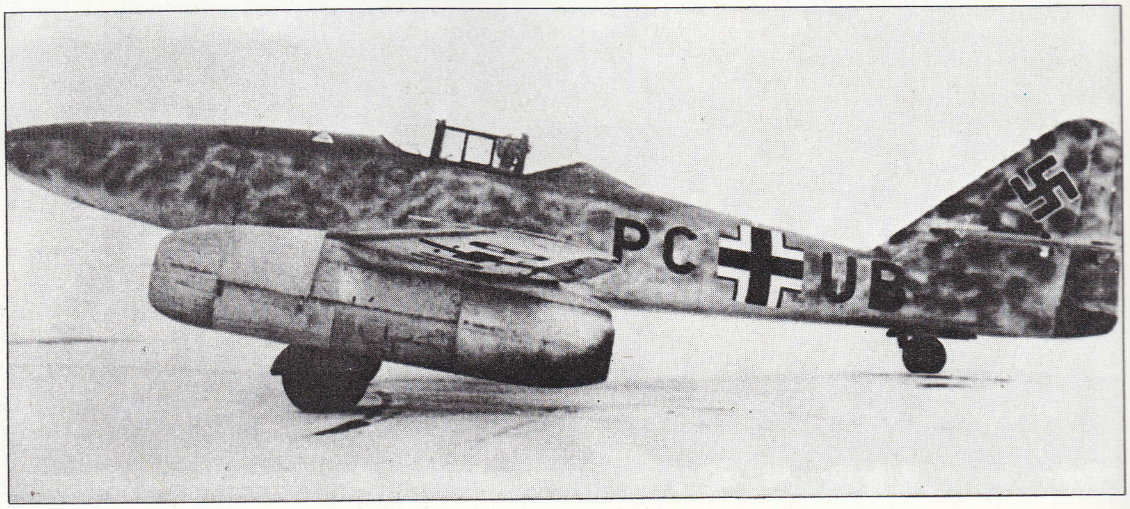
Performance: maximum speed 870 km/h (541 mph) at 7000 m (26,965 ft); initial climb rate 1200 m (3,937 ft) per minute; service ceiling 11000 m (36,090 ft); normal range 845 km (525 miles)

Weights: empty 4000 kg (8,818 lb); maximum take-off 6775 kg (14,936 lb)

Dimensions: span 12.50 m (41 ft 0⅛ in); length 10.61 m (34 ft 9½ in); height 3.83 m (12 ft 6¾ in); wing area 21.68 m² (233.3 sq ft)

Armament: four MK 108 30-mm cannon in nose

Featuring a tailwheel, the Me 262V-2 became the second Me 262 to fly solely on turbojet power, the first prototype having a piston engine as well as the jets mounted in the nose.



Messerschmitt Me 262 in Action

Despite the political wrangles, and untried features, the Me 262 proved itself in action as an excellent aircraft, with superb handling and devastating firepower. It pointed the way for future jet development.

There has been prolonged argument about which was the first jet fighter, or the first in service; and also about whether or not Hitler's insistence on using the Messerschmitt Me 262 as a bomber made any difference to this particular programme or to the course of the war. Though there is room for argument over all questions of 'firsts', it is beyond question that of all the many wartime jets the Me 262 was built in the largest numbers, and saw by far the greatest amount of action.

First flown with its Jumo 004 turbojets, with no piston engine in the nose, on 18 July 1942, the Me 262 was in many ways an inspired design, though the slight sweepback of its wing was not intended to postpone drag rise at high Mach numbers. Apart from its radical propulsion system and diesel oil fuel, the Me 262A-1a fighter and Me 262A-2a fighter-bomber set wholly new standards in their clean design, good tricycle landing gear, all-round vision, jettisonable canopy, large fuel capacity (giving about 1-hour endurance despite the very high fuel consumption) and devastating armament, which in the standard Me 262A-1a was four 30-mm MK 108 cannon putting out 72 kg (158 lb) of extremely destructive shells in a five-second burst. Moreover, in full flight the Me 262 handled like a dream. Though rate of roll was inevitably reduced by the relatively large span (compared with the Messerschmitt Bf 109 and Focke-Wulf Fw 190) and engines mounted outboard, the general handling was superb, and a vast improvement over that of the Bf 109G.

At the same time the Me 262 had its faults, and some were dangerous. By far the most important was the relatively undeveloped state of the Jumo 004B engine, which was nevertheless an extraordinary achievement, especially as it used the technically difficult axial compressor and had to manage with poor materials. The worst feature was that, whereas with piston engines the throttle could be suddenly closed or quickly banged open, such treatment to an 004B would cause fire, flame-out and mechanical failure. Pilots soon learned if possible to leave the throttles alone, and formation flying was thus very difficult. The most dangerous feature was that throttles had to be closed on the landing approach, and the landing had to be right first time. Any attempt to open up and go round again would cause loss of control from asymmetric power, total engine failure, inflight fire or simply such slow build-up of power that the aircraft would in any event hit the ground.

Into action

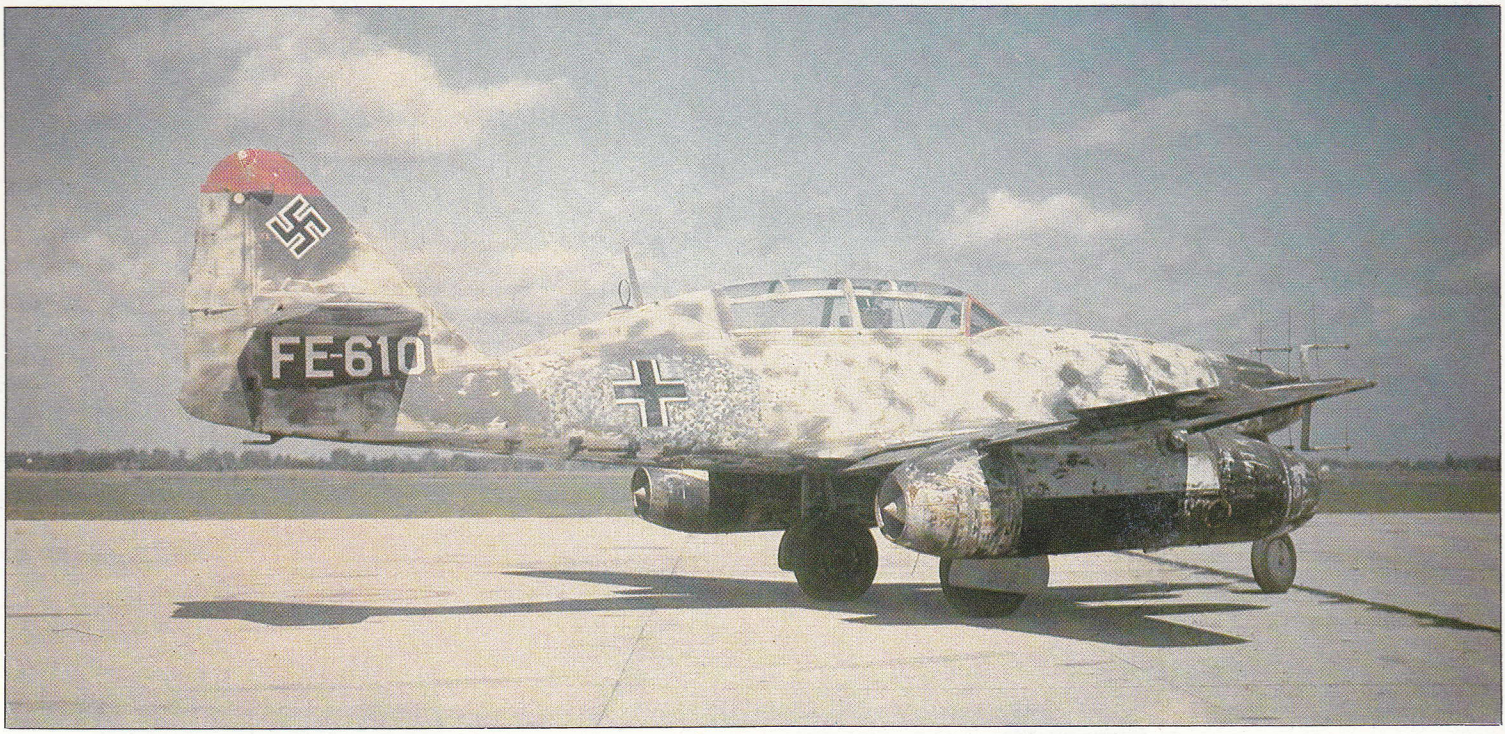
Of the 23 pre-production Me 262A-0 aircraft built in the first three months of 1944, 15 were assigned to the first semi-operational test unit, Ekdo (Erprobungskommando) 262, formed at Lechfeld in late April under Hauptmann Wernher Thierfelder. Aircraft began to arrive in late May and service flying began in mid-July with 12 aircraft. Various problems encountered included the novel phenomenon of compressibility at Mach numbers beyond 0.83, which resulted in at least two write-offs and possibly explained the crash of Thierfelder's own aircraft on 18 July. But Thierfelder's successor was Major Walter Nowotny, a 255-victory ace with great powers of organization and leadership. Crashed aircraft were quickly replaced, and on 25 July an obviously inexperienced Ekdo 262 pilot intercepted an RAF de Havilland Mosquito PR.Mk XVI of No. 544 Sqn flown by Flight Lieutenant Wall, who not only avoided the firing passes but even got on the jet's tail. Another No. 544 Sqn aircraft, flown by Flight Lieutenant Ewall, likewise evaded an Me 262's shells on the same day. From then on, photo-reconnaissance Mosquitoes were intercepted frequently by these very much faster aircraft, but the experienced RAF crews usually managed to get away with it, a run at full throttle at low level being a good way to reduce the Me 262's fuel state in minutes.

First successes

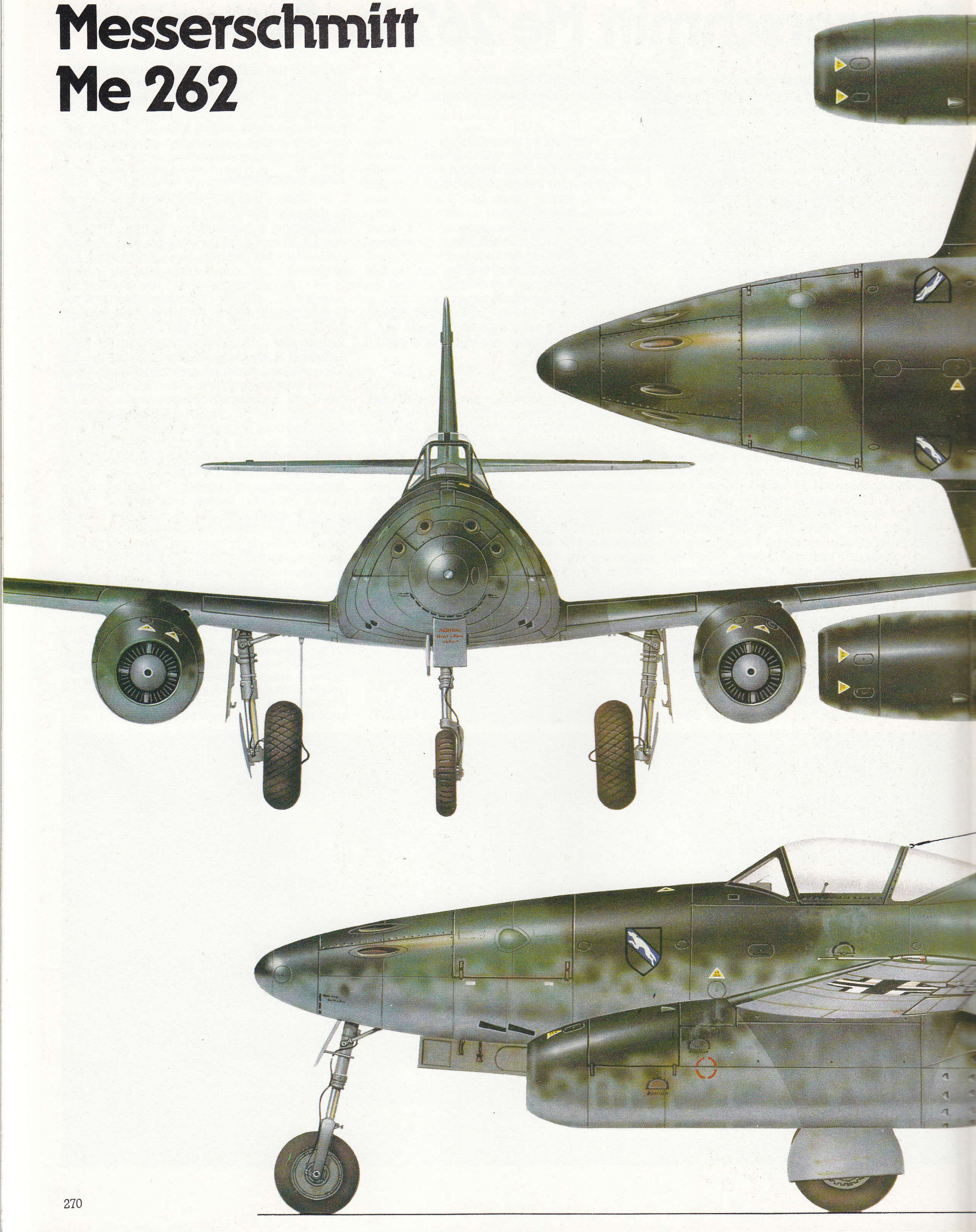
In August Ekdo 262 claimed five victories, all to different pilots: two photo-reconnaissance Mosquitoes, a Supermarine Spitfire, a Lockheed P-38 and a solitary Boeing B-17. Against the B-17 the MK 108 guns were devastating, but in fighter combat and in attacks on ground targets (which came later) the low muzzle velocity was criticized in comparison with the higher performance of the MG 151, which, though less destructive, had better ballistics. Various other weapons were tested in Me 262s, including the monster 50-mm BK 5, but the Mk 108 remained standard, and in the Me 262A-2a fighter-bomber only two were fitted to a proportion of the aircraft delivered.

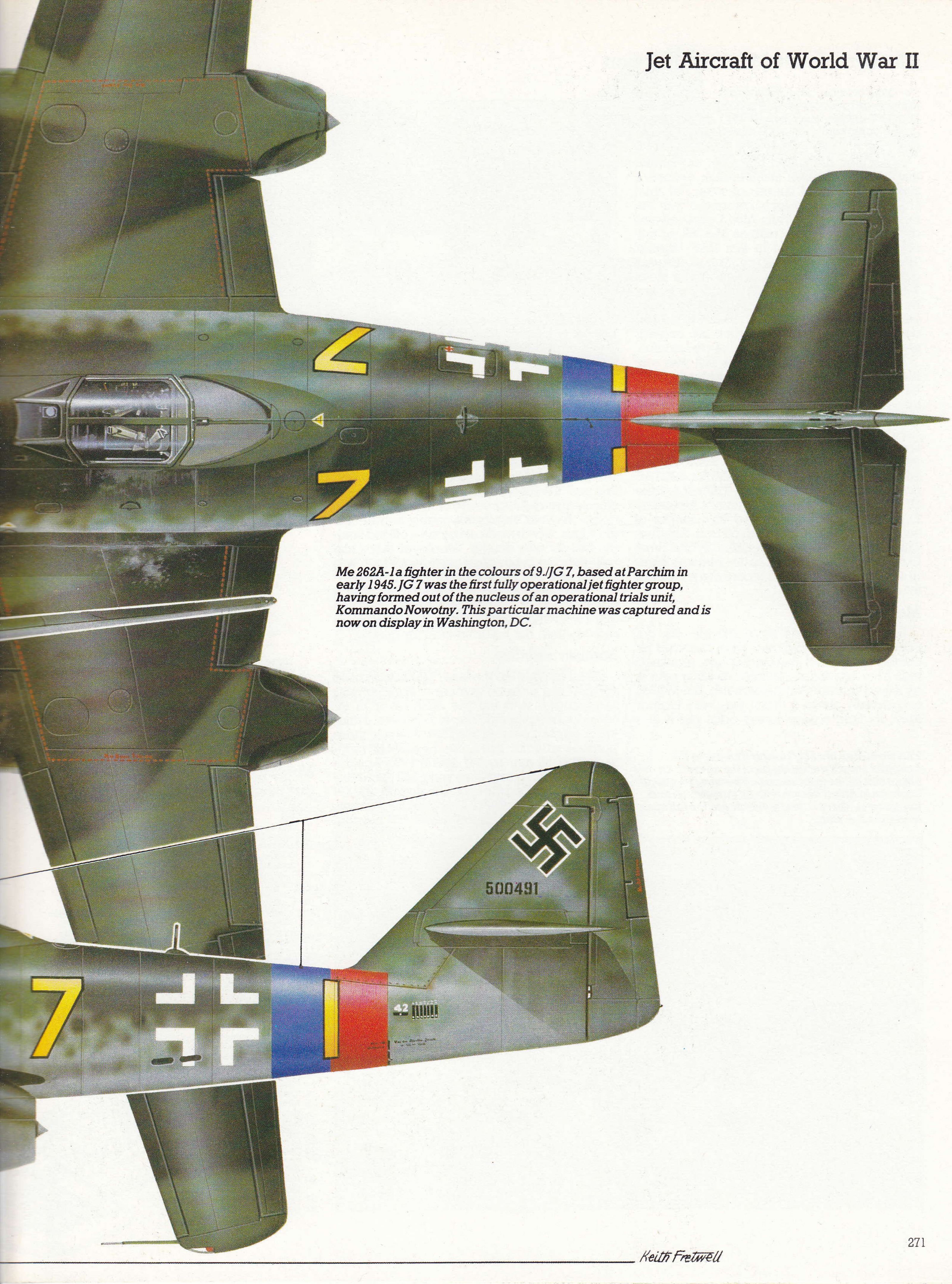
This version, produced under intense pressure from Hitler himself, began to come off production in the first week of July 1944, with two pylons under the nose for 250-kg (551-lb) bombs (or a single SC500 of twice this size). In August operations began by the first Me 262A-2a unit, the Ekdo Schenk, a detachment of the famed bomber wing KG 51. This had formed beside Ekdo 262 at Lechfeld, but moved to various airfields in northern France and Belgium trying to get started on operations. August was spent rather ineffectively bombing from heights over 4000 m (13,125 ft) to avoid losses, and air combats were avoided, but on 28 August Oberfeldwebel Lauer was unlucky

With an extra seat for a radar operator, the Me 262B-1a/U1 was flown during March 1945 as a night fighter in defence of Berlin. The Hirschgeweih *(stag's antlers) radar array on the nose is of the Neptun V type. This aircraft is shown in markings applied after capture by the Allies.*

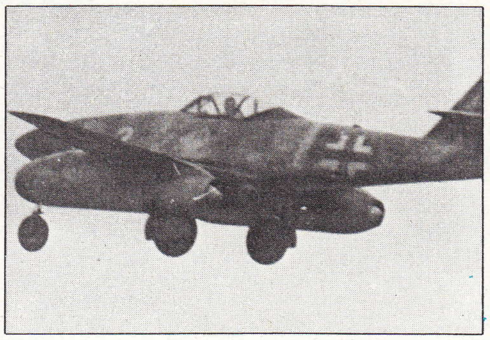


Messerschmitt Me 262

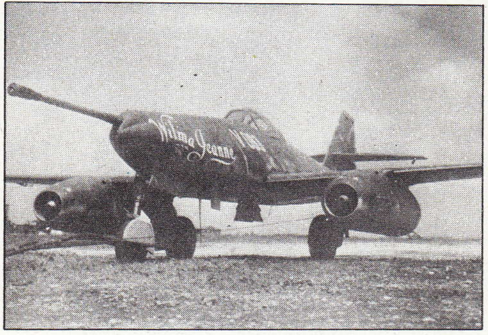




Me 262A-1a fighter in the colours of 9./JG 7, based at Parchim in early 1945. JG 7 was the first fully operational jet fighter group, having formed out of the nucleus of an operational trials unit, Kommando Nowotny. This particular machine was captured and is now on display in Washington, DC.



The Me 262A became a fully operational fighter-bomber in late 1944. It immediately gained the respect of its pilots, proving easy to handle, fast (sometimes too fast, with fabric ballooning during dives), having excellent visibility from the bubble cockpit and packing a mighty punch for its day.



One of the more interesting experiments conducted with the Me 262 was the fitting of a 50-mm Rheinmetall BK 5 cannon for anti-bomber strikes. The barrel projected 2 m (7 ft) ahead of the nose and a counter-weight was added in the rear fuselage to maintain centre of gravity.

enough to meet Major Joseph Myers, 78th FG, USAAF, whose Republic P-47D at full power managed to keep heading the jet off near Brussels until it crash-landed in a field.

At no time did Allied pilots get the feeling that the Me 262 was invulnerable, despite a superiority in level speeds of some 160 km/h (100 mph) at most heights compared with the fastest Allied types. Thus Allied pilots always did their best to close with an Me 262, or any other German jet, and in fact RAF Hawker Tempests alone scored 20 confirmed victories over Me 262s by VE-day. At least five of these were aircraft whose pilots confidently believed they had outrun the opposition and, without searching the sky behind, slowed down to save wear on the short-life engines and were soon met by a burst of cannon fire.

In general, however, the Me 262 was safe from Allied fighters if it was competently flown by a pilot who kept a good look-out. The only time it was obviously vulnerable was in the vicinity of its home airfield. Here the pilot was not only flying slowly but also concerned to work the temperamental engines and make a very accurate landing approach. At least 21 Me 262s were shot down by RAF or USAAF fighters at the bases, and a P-51D pilot of the 361st Fighter Group, Lieutenant Urban L. Drew, managed to bag two in a matter of seconds after they had taken off from Achmer. This was a unique achievement. By this time, October 1944, plenty of Gloster Meteors were in service, but there is no record of a jet against jet encounter.

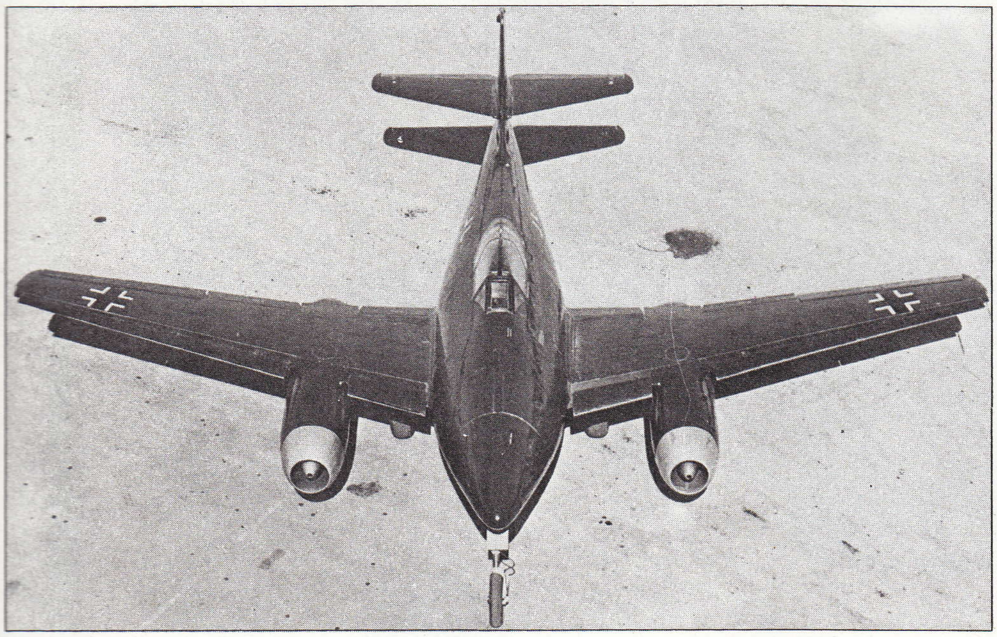
Me 262 setbacks

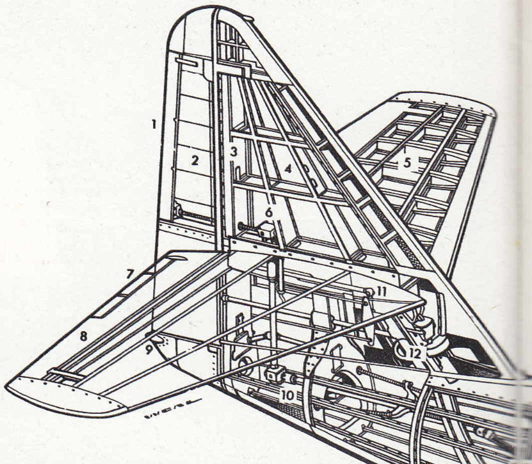
By November 1944 some 200 Me 262s (of about 420 constructed) had been received by combat units, and though attrition remained high from accidents, and from standing patrols by Allied fighters over the airfields, the Me 262 occasionally showed that it was very formidable. Its fight against heavy odds put it at a grave disadvantage, however, and after Nowotny was killed on 8 November General Adolf Galland ordered the fighter Ekdo to rest and undergo intensive training. In the same month the first regular fighter wing, JG 7, was set up under Oberst Johannes Steinhoff, and this and KG 51's Me 262A-2as built up to become large and impressive units, though by the end of the year the sky was totally in control of the Allies, which made every take-off and landing fraught with danger. Moreover there had now arisen a major argument over which was better: Me 262 fighter pilots with no experience and unschooled in navigation or instrument flying, or ex-bomber pilots (of which there were thousands) with long experience in such matters but not trained in air combat.

Bomber attacks

As far as possible the latter pilots were used either in the growing number of bomber units re-equipped with the Me 262A-2a or in interceptions against US heavy bombers, avoiding dogfights as far as possible. A few of these bomber attacks used the new R4M spin-stabilized 55-mm rocket carried on wooden 12-round racks under each wing, but the several other advanced weapons, including the X-4 wire-guided missile, did not get into action. Another new development which did become operational was the tandem-seat Me 262B-1a/U1 night-fighter, an interim conversion with reduced fuel capacity which nevertheless ended the immunity previously enjoyed by RAF Mosquitoes at night. The Kommando Welter which

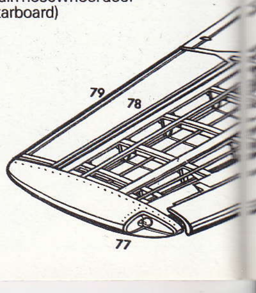
This view of an Me 262A amply illustrates the beautiful aerodynamic shape of the aircraft, an important factor in its success. The wing was far in advance of Allied design with its thin section and gentle sweepback. Clearly visible are the full span leading-edge slats.

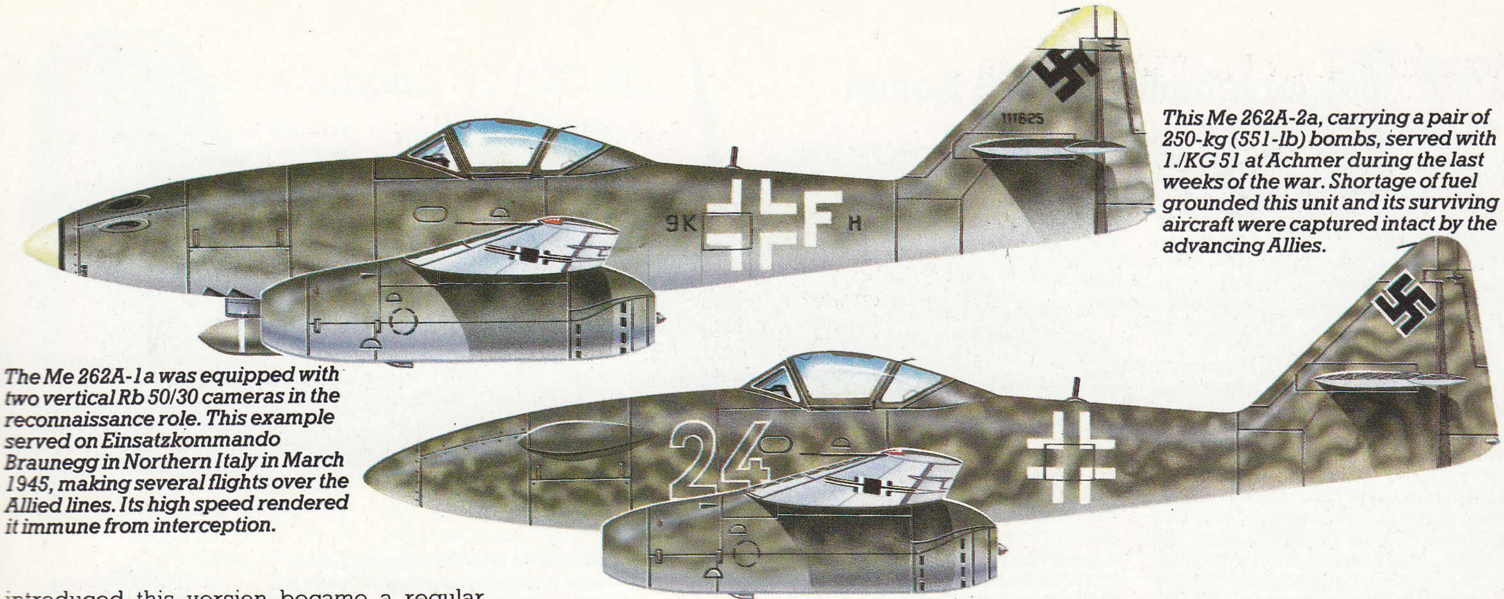




Messerschmitt Me 262A-1a cutaway drawing key

1 Flettner-type geared trim tab
2 Mass-balanced rudder
3 Rudder post
4 Tail fin structure
5 Tailplane structure
6 Rudder tab mechanism
7 Flettner-type servo tab
8 Starboard elevator
9 Rear navigation light
10 Rudder linkage
11 Elevator linkage
12 Tailplane adjustment mechanism
13 Fuselage break point
14 Fuselage construction
15 Control runs
16 FuG 25a loop antenna (IFF)
17 Automatic compass
18 Aft auxiliary self-sealing fuel tank (132 Imp gal/600 litre capacity)
19 FuG 16zy R/T
20 Fuel filler cap
21 Aft cockpit glazing
22 Armoured aft main fuel tank (198 Imp gal/900 litre capacity)
23 Inner cockpit shell
24 Pilot's seat
25 Canopy jettison lever
26 Armoured (15-mm) head rest
27 Canopy (hinged to starboard)
28 Canopy lock
29 Bar-mounted Revi 16B sight (for both cannon and R4M missiles)
30 Armourglass windscreen (90-mm)
31 Instrument panel
32 Rudder pedal
33 Armoured forward main fuel tank (198 Imp gal/900 litre capacity)
34 Fuel filler cap
35 Underwing wooden rack for 12 R4M 55-mm rockets
36 Port outer flap section
37 Frise-type aileron
38 Aileron control linkage
39 Port navigation light
40 Pitot head
41 Automatic leading-edge slats
42 Port engine cowling
43 Electrical firing mechanism
44 Firewall
45 Spent cartridge ejector chutes
46 Four 30-mm Rheinmetall Borsig MK 108 cannon (100 rpg belt-fed ammunition for upper pair and 80 rpg for lower pair)
47 Cannon muzzles
48 Combat camera
49 Camera aperture
50 Nosewheel fairing
51 Nosewheel leg
52 Nosewheel
53 Torque scissors
54 Retraction jack
55 Hydraulic lines
56 Main nosewheel door (starboard)





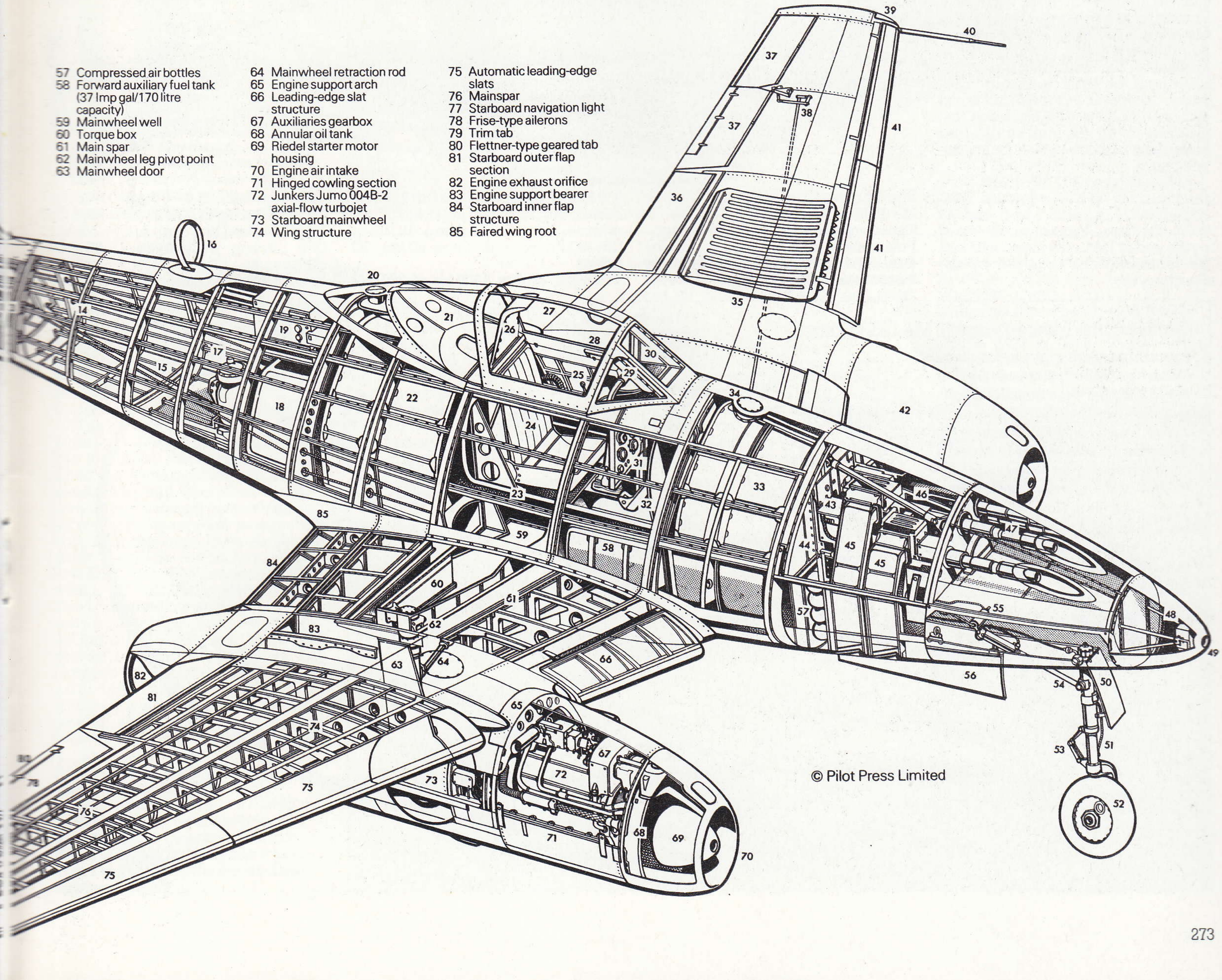
This Me 262A-2a, carrying a pair of 250-kg (551-lb) bombs, served with 1./KG 51 at Achmer during the last weeks of the war. Shortage of fuel grounded this unit and its surviving aircraft were captured intact by the advancing Allies.

The Me 262A-1a was equipped with two vertical Rb 50/30 cameras in the reconnaissance role. This example served on Einsatzkommando Braunegg in Northern Italy in March 1945, making several flights over the Allied lines. Its high speed rendered it immune from interception.

introduced this version became a regular night-fighter *Staffel*, 10./NJG 11, in April 1945 defending Berlin, and scored several victories, but it did not come anywhere near equalling the five confirmed Mosquitoes by Feldwebel Becker between 21 and 30 March flying a standard single-seat Me 262 without radar.

Many eminent officers lost their appointments over the Me 262, one being General der Jagdflieger (General of Fighters) Galland. He was, however, permitted to form an elite Me 262 fighter unit staffed by pilots of his own choosing, and this outfit, JV 44, did its best to restore an impossible situation in the Third Reich's last agonies. After training alongside JG 7 this crack group went into action on the last day of March 1945. It operated in the anti-bomber role, initially from Munich-Riem and then from straight stretches of *Autobahn* before finally being overrun by US armour at Salzburg. In just a month JV 44 scored about 50 kills, using guns and R4Ms; but it took many air-combat losses.

Altogether, of 1,433 Me 262s that were flown out of maker's airfields, some 500 reached combat units. They shot down about 150 Allied aircraft, but lost about 100 in combat and 240 in accidents.



57 Compressed air bottles
58 Forward auxiliary fuel tank (37 Imp gal/170 litre capacity)
59 Mainwheel well
60 Torque box
61 Main spar
62 Mainwheel leg pivot point
63 Mainwheel door
64 Mainwheel retraction rod
65 Engine support arch
66 Leading-edge slat structure
67 Auxiliaries gearbox
68 Annular oil tank
69 Riedel starter motor housing
70 Engine air intake
71 Hinged cowling section
72 Junkers Jumo 004B-2 axial-flow turbojet
73 Starboard mainwheel
74 Wing structure
75 Automatic leading-edge slats
76 Mainspar
77 Starboard navigation light
78 Frise-type ailerons
79 Trim tab
80 Flettner-type geared tab
81 Starboard outer flap section
82 Engine exhaust orifice
83 Engine support bearer
84 Starboard inner flap structure
85 Faired wing root

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GERMANY

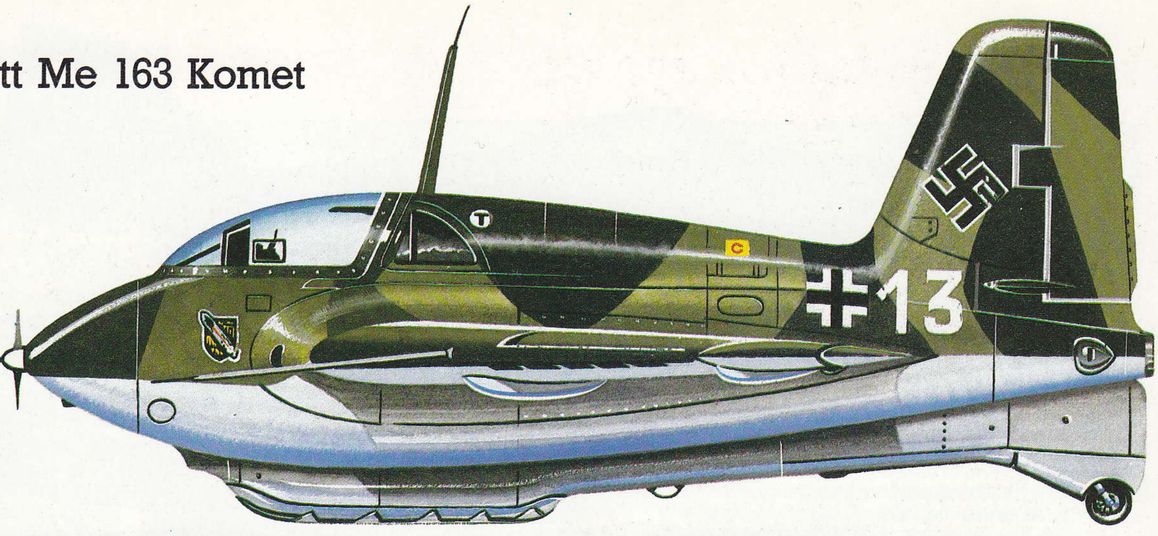
Messerschmitt Me 163 Komet

The **Messerschmitt Me 163 Komet** (comet) rocket interceptor stemmed from prolonged research by Dr Alexander Lippisch over 15 years before the war. The prototype was initially test flown as a glider during the spring of 1941 before being fitted with a Walter RII-203 rocket using *T-Stoff* and *Z-Stoff* propellants. Powered flights by the **Me 163 V1** started in the late summer of 1941, and on 2 October the aircraft reached 1004.5 km/h (623.8 mph); two months later the **Me 163B Komet** was ordered into production.

Production Me 163Bs were powered by Walter 109-509A rocket motors using *T-Stoff* (hydrogen peroxide) and *C-Stoff* (hydrazine hydrate, methyl alcohol and water) to give a thrust of 1700 kg (3,748 lb). Early **Me 163B-0** aircraft were armed with a pair of 20-mm guns, but **Me 163B-1** fighters carried two 30-mm weapons. The aircraft possessed no conventional landing gear, but took off from a trolley which was jettisoned immediately after take-off.

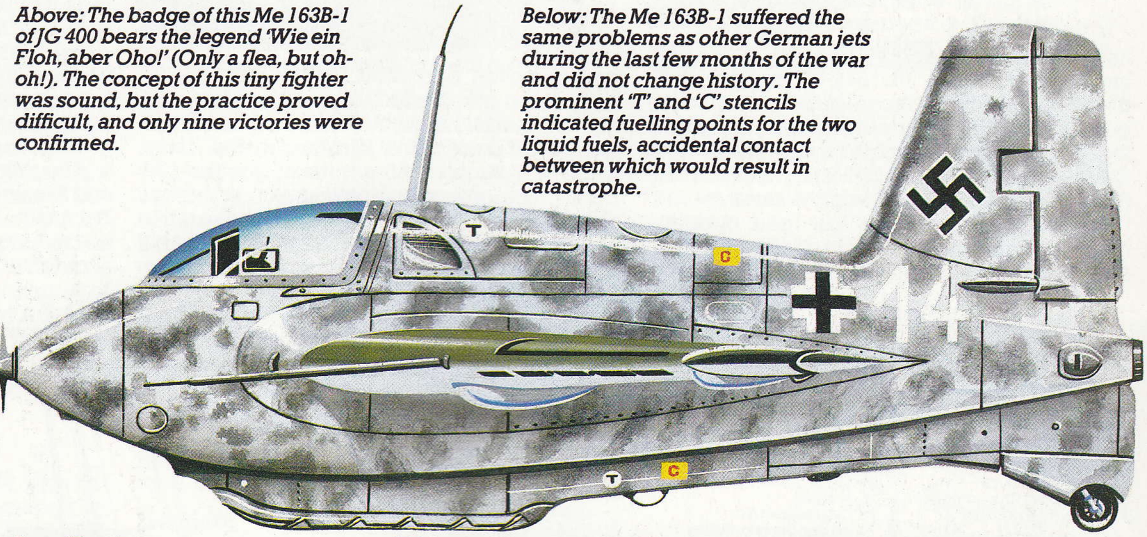
Introduction to Luftwaffe service was a protracted and hazardous process owing to difficulties in handling the fuels and a number of fatal accidents, and only very experienced pilots were selected. Production **Me 163B-1a** fighters equipped I/JG 400 at Brandis, near Leipzig, in June 1944 and first intercepted B-17 Fortress daylight bombers on 16 August that year. All manner of difficulties faced the pilots, apart from the hazards already mentioned, and it was found difficult to aim and fire the guns with the result that upward-firing 50-mm shells and underwing rockets came to be developed.

Although some 300 Me 163Bs were produced (as well as a few **Me 163C** aircraft with increased fuel) and JG 400's other two *Gruppen* re-equipped by the end of 1944, only nine confirmed air victories were achieved by the *Geschwader*.



Above: The badge of this Me 163B-1 of JG 400 bears the legend 'Wie ein Floh, aber Oho!' (Only a flea, but oh-oh!). The concept of this tiny fighter was sound, but the practice proved difficult, and only nine victories were confirmed.

Below: The Me 163B-1 suffered the same problems as other German jets during the last few months of the war and did not change history. The prominent 'T' and 'C' stencils indicated fuelling points for the two liquid fuels, accidental contact between which would result in catastrophe.



Specification

Me 163B-1a Komet

Type: single-seat interceptor fighter

Powerplant: one 1700-kg (3,748-lb) thrust Walter 109-509A-2 rocket motor

Performance: maximum speed 960 km/h (596 mph) at 3000 m (9,845 ft); initial climb rate 3600 m (11,810 ft) per minute; service ceiling 12100 m (39,700 ft); normal range 80 km (50 miles)

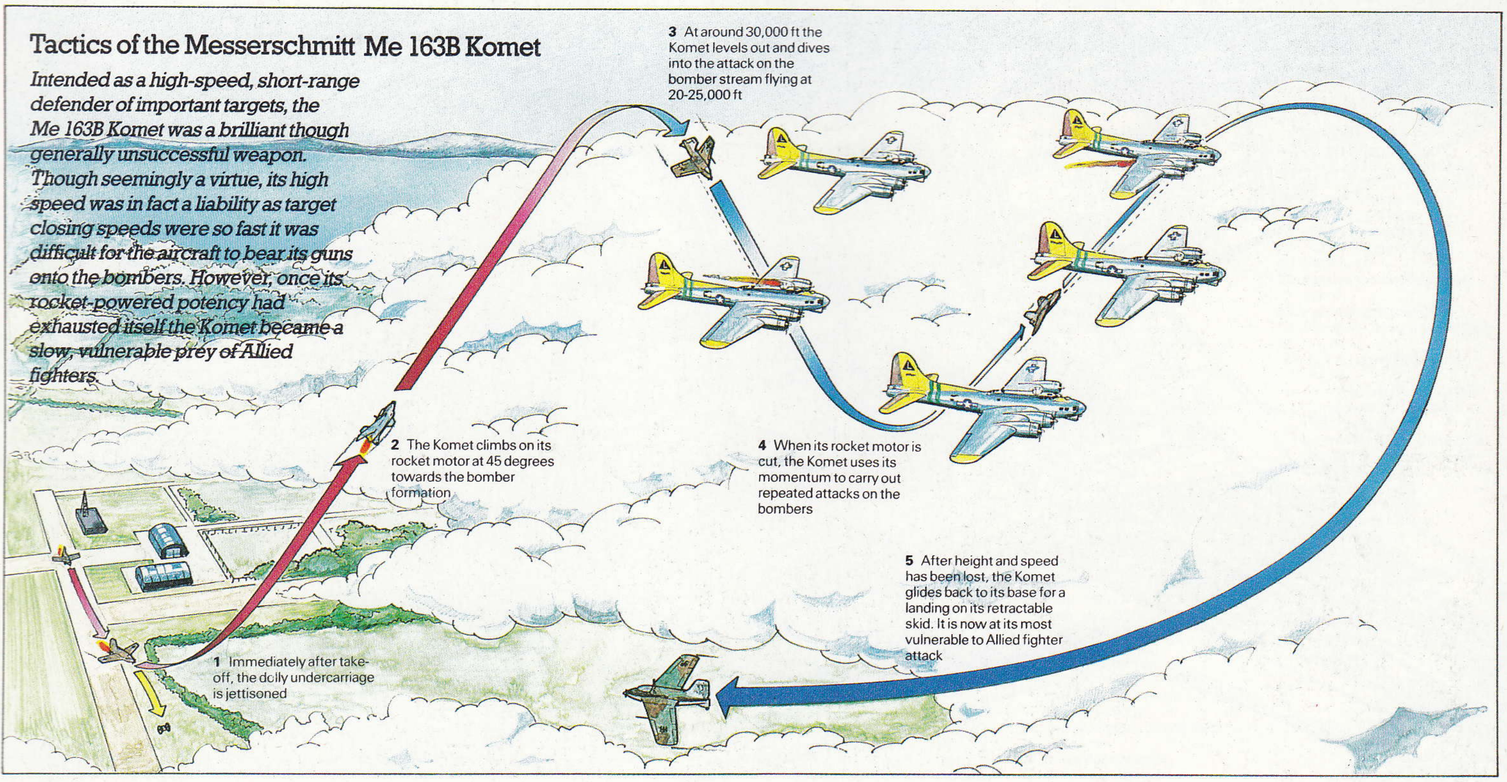
Weights: empty 1905 kg (4,200 lb); maximum take-off 4110 kg (9,061 lb)

Dimensions: span 9.33 m (30 ft 7¼ in); length 5.69 m (18 ft 8 in); height 2.76 m (9 ft 0½ in); wing area 19.62 m^2 (211.2 sq ft)

Armament: two 30-mm MK 108 cannon

Tactics of the Messerschmitt Me 163B Komet

Intended as a high-speed, short-range defender of important targets, the Me 163B Komet was a brilliant though generally unsuccessful weapon. Though seemingly a virtue, its high speed was in fact a liability as target closing speeds were so fast it was difficult for the aircraft to bear its guns onto the bombers. However, once its rocket-powered potency had exhausted itself the Komet became a slow, vulnerable prey of Allied fighters.



1 Immediately after take-off, the dolly undercarriage is jettisoned

2 The Komet climbs on its rocket motor at 45 degrees towards the bomber formation

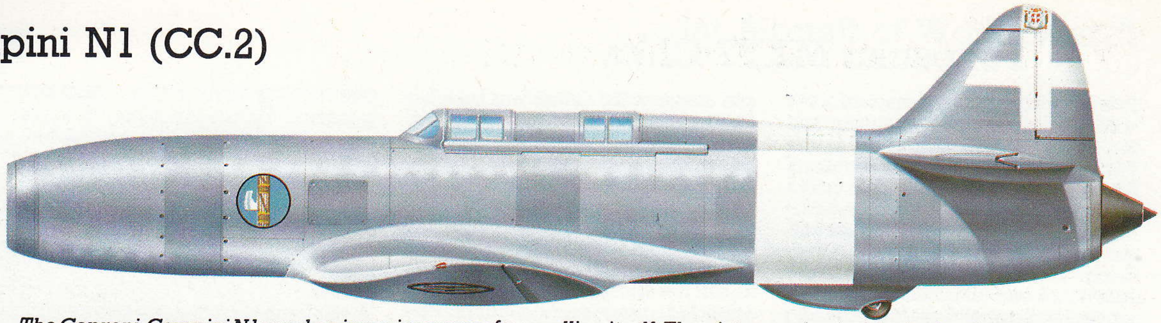
3 At around 30,000 ft the Komet levels out and dives into the attack on the bomber stream flying at 20-25,000 ft

4 When its rocket motor is cut, the Komet uses its momentum to carry out repeated attacks on the bombers

5 After height and speed has been lost, the Komet glides back to its base for a landing on its retractable skid. It is now at its most vulnerable to Allied fighter attack

ITALY

Caproni-Campini N1 (CC.2)

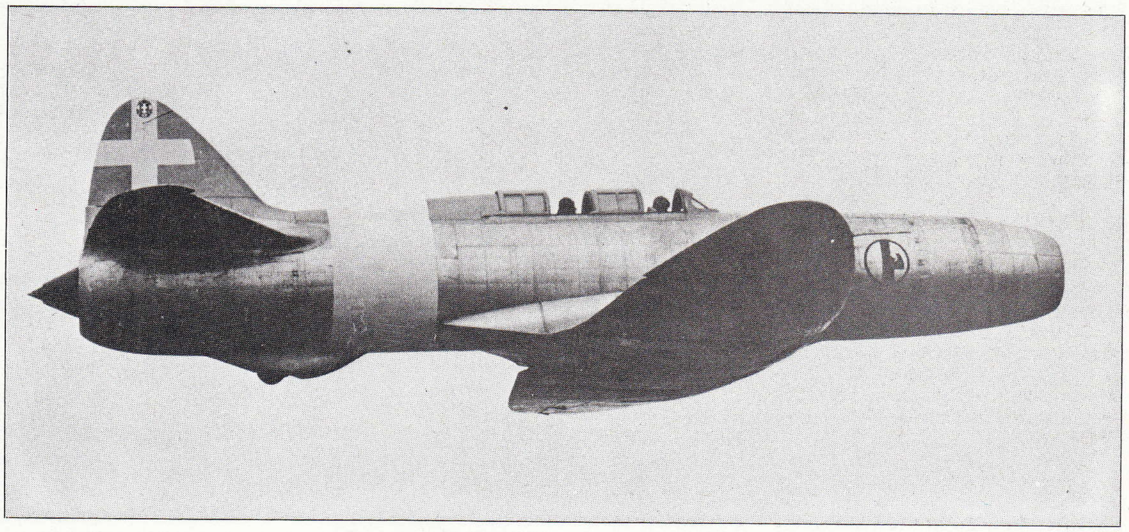


The Caproni-Campini N1 used an ingenious way of propelling itself. The piston engine inside the fuselage drove a ducted fan and fuel was bled and ignited in the compressed air emitted through the tailpipe.

It is perhaps surprising at first sight that, having been the second nation to fly an air-breathing jet-propelled aeroplane, Italy did not feature among the leading nations in this field of technology. But in truth the **Caproni-Campini N1** was no more than an ingenious freak which employed a conventional piston engine to drive a variable-pitch ducted-fan compressor with rudimentary afterburning. As such it did nothing to further gas turbine research, and was to all intents and purposes a technical dead-end. The engineer Secondo Campini had created a company in 1931 to pursue research into reaction propulsion and in 1939 persuaded Caproni to build an aircraft to accommodate the fruits of this work, namely the adaptation of an Isotta-Fraschini radial engine driving a ducted-fan compressor; the compressed air was exhausted through a variable-area nozzle in the aircraft's extreme tail, and additional fuel could be ignited in the tailpipe to increase thrust. The two-seat low-wing N1 (sometimes referred to as the **CC.2**) was first flown at Taliedo on 28 August 1940 by Mario de Bernadi. A number of set-piece demonstration flights was undertaken, including one of 270 km (168 miles) from Taliedo to Guidonia at an average speed of 209 km/h (130 mph), but it was clear from the outset that use of a three-stage fan-compressor driven by a piston engine would limit further development, and the experiment was abandoned early in 1942 when Italy was faced with sterner priorities. The N1 survives today in the Museo della Scienza Technica at Milan as a monument to ingenuity if not sophisticated technology.

Specification

Type: two-seat research aircraft
Powerplant: one 900-hp (671-kW) Isotta-Fraschini radial piston engine driving a three-stage ducted-fan compressor
Performance: maximum speed 375 km/h (233 mph)
Weights: empty 3640 kg (8,025 lb); maximum take-off 4195 kg (9,248 lb)
Dimensions: span 15.85 m (52 ft 0 in); length 13.10 m (43 ft 0 in); wing area 36.00 m^2 (387.51 sq ft)
Armament: none



With a maximum speed of only 375 km/h (233 mph), the N1 served only to prove its propulsion concept was possible. The design limitations meant that development would be fruitless, and as Italy's war effort gained momentum, thoughts turned to more immediate problems.

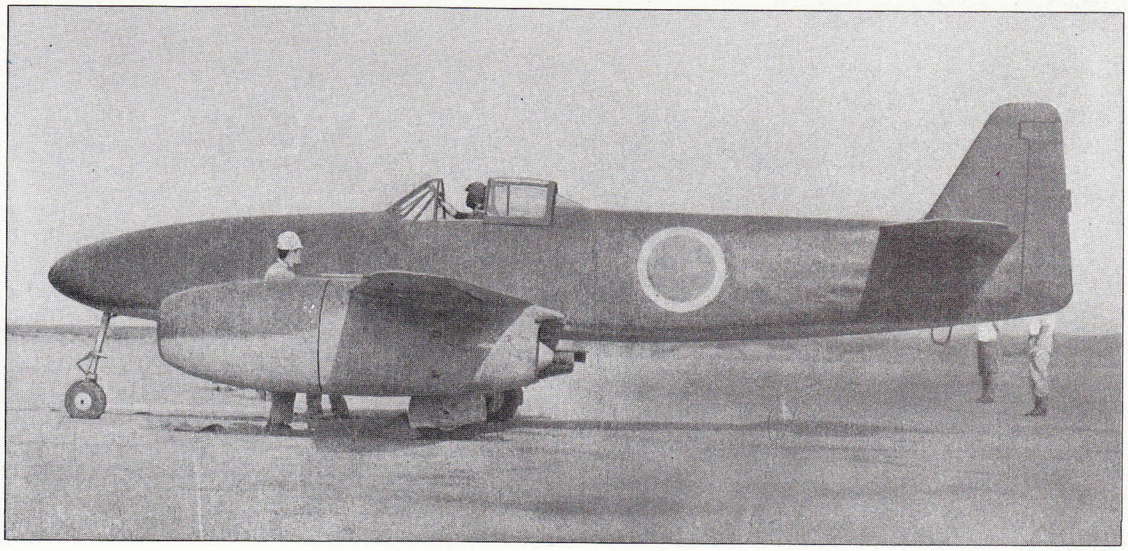
JAPAN

Nakajima Kikka

Encouraged by enthusiastic reports of the German Messerschmitt Me 262 from the Japanese air attaché in Berlin, the Japanese naval staff instructed Nakajima to develop a single-seat attack bomber based on the Me 262, capable of a speed of 690 km/h (430 mph) and able to carry a small bombload. Design started in September 1944 under the direction of Kazuo Ohno and Kenichi Matsumur, and the resulting aircraft resembled the German design although somewhat smaller owing to the very low power available from the early Japanese jet engines. Initially the first prototype **Nakajima Kikka** (orange blossom) was fitted with a pair of 200-kg (440-lb) thrust Tsu-11 ducted-flow engines, but these were quickly replaced by 340-kg (750-lb) thrust Ne-12 turbojets. These also proved inadequate and for the first flight two 475-kg (1,047-lb) thrust Ne-20 axial-flow turbojets were fitted; however, it was still necessary to employ an auxiliary rocket for assisted take-off. The Kikka was first flown on 7 August 1945 at Kisarazu Naval Air Base by Lieutenant Commander Sasumu Tanaoka; the second flight ended in damage when Tanaoka abandoned the take-off owing to the ATO rockets being incorrectly mounted. A second prototype was then nearing completion and manufacture of 18 further aircraft had started when, on 15 August, the entire programme was abandoned. Production, which included versions for training, reconnaissance and air combat, had also been planned.

Specification

Kikka (1st prototype)
Type: single-seat attack bomber
Powerplant: two 475-kg (1,047-lb) thrust Ne-20 axial-flow turbojets
Performance: maximum speed 697 km/h (433 mph) at 10000 m (32,810 ft); climb to 10000 m (32,810 ft) in 26 minutes; service ceiling 12000 m (39,370 ft); range 940 km (586 miles)
Weights: empty 2300 kg (5,071 lb); maximum take-off 4080 kg (8,995 lb)
Dimensions: span 10.00 m (32 ft 9¾ in); length 8.125 m (26 ft 7⅞ in); height 2.95 m (9 ft 8⅛ in); wing area 13.2 m^2 (142.08 sq ft)
Armament: one 500-kg (1,102-lb) or one 800-kg (1,764-lb) bomb; fighter version proposed with two 30-mm Type 5 cannon in nose

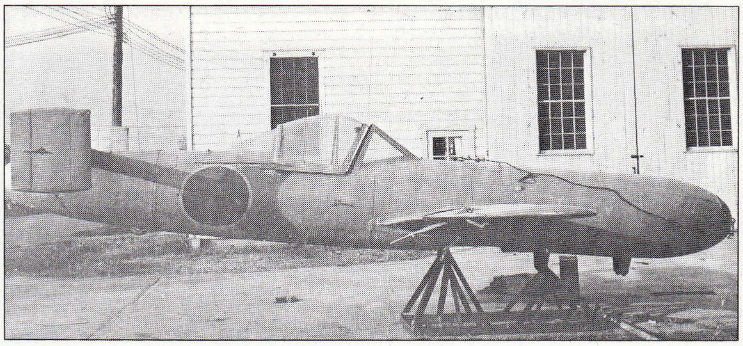


Based on the Me 262, the Kikka had less power and had to be built smaller. Even then it had too little power and needed rockets to get it off the ground. Only one example flew before the programme was abandoned due to the impending Japanese defeat.

JAPAN

Yokosuka MXY7 Ohka

It was during the summer of 1944 when, faced with overwhelming and fast-increasing Allied strength in the Pacific theatre, the Japanese naval staff first seriously entertained the concept of employing suicide tactics to defeat enemy attacks, and it was Ensign Mitsuo Ohta who first produced a rough design for a piloted flying bomb, a design which was assigned to Yokosuka for detailed completion. The resulting device was a small, mainly wooden aircraft with three solid-propellant rockets in the rear fuselage and a 1200-kg (2,646-lb) explosive warhead in the nose. Carried aloft in the bomb bay of a modified Mitsubishi G4M bomber and flown towards the target area, the **Yokosuka MXY7 Ohka** (cherry blossom) bomb would be released, its rockets fired and then flown directly to impact on a selected target; the pilot was sealed into his cockpit before take-off. Initial powered flights started at Sagami in October 1944, followed by unmanned, powered flights the next month. Production was put in hand, and a total of 755 Ohkas was built before March 1945 when production ended. The weapon was first employed by the 721st Kokutai on 21 March 1945, but the carrier aircraft were intercepted and forced to release their flying bombs too early. On 1 April the US battleship *West Virginia* and three transport vessels were hit and damaged by Ohkas. Limited success attended other suicide attacks by Ohkas, but the transport aircraft proved fatally vulnerable in the presence of powerful American defences and the Japanese suicide tactic was never a serious threat to Allied operations in the Pacific, for all its macabre implications.



Powered by three rockets in the tail, the Ohka was a piloted bomb released from its mother aircraft when near the target. The pilot was sealed into his cockpit before the flight, so once released he had only one hope: to cause maximum damage to his target.

Specification
Ohka Model 11

Type: single-seat suicide aircraft

Powerplant: three solid-fuel Type 4 Mark 1 Model 20 rockets with total thrust of 800 kg (1,764 lb)

Performance: maximum level speed 650 km/h (403 mph); terminal diving speed 927 km/h (576 mph); range 37 km (23 miles)

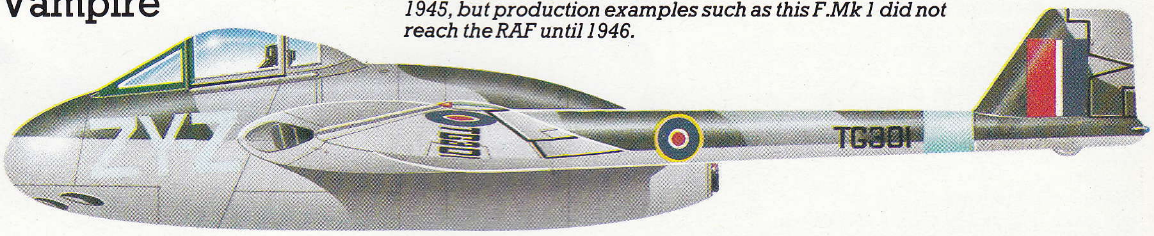
Weights: empty 440 kg (970 lb); maximum take-off 2140 kg (4,718 lb)

Dimensions: span 5.12 m (16 ft 9½ in); length 6.07 m (19 ft 10¾ in); height 1.16 m (3 ft 9⅝ in); wing area 6.0 ^{2} (64.6 sq ft)

Warhead: 1200 kg (2,646 lb)

UK

de Havilland Vampire



The first production Vampire made its first flight in April 1945, but production examples such as this F.Mk 1 did not reach the RAF until 1946.

Among the earliest British gas turbines destined for flight was the Halford H.1, designed by Major F.B. Halford and manufactured by de Havilland. In response to Air Ministry Specification E.6/41 the de Havilland company decided to employ this engine in a radical little fighter prototype initially known as the **Spidercrab.** In an effort to avoid thrust losses through long intake and exhaust ducts the engine intakes were located in the wing roots and the fuselage terminated immediately aft of the engine jet pipe, the aircraft's tail being carried on slender twin booms. The result was an extremely neat and compact design, and the first flight of the prototype, made by Geoffrey de Havilland Jr, took place at Hatfield in Hertfordshire on 20 September 1943, just 16 months after the start of design, the aircraft (LZ548/G) featuring pointed fins. Two further prototypes (LZ551/G and MP838/G) quickly joined the flight programme, the latter carrying the planned armament of four 20-mm Hispano cannon under the nose. The name was changed to **Vampire** and on 13 May 1944 a contract for 120 production examples of the **Vampire F.Mk I** (later increased to 300) was placed for manufacture by the English Electric Company, Preston. The first production aircraft (TG274/G), with square-cut fins and Goblin turbojet (as the Halford engine was named) was flown at Samlesbury on 20 April 1945, becoming the first British fighter with a speed of over 805 km/h (500 mph). Pre-service and handling trials occupied the remainder of 1945, however, and the Vampire saw no operational service during the war, entering RAF Fighter Command in the summer of 1946.

Specification

Type: single-seat interceptor fighter

Powerplant: one 1225-kg (2,700-lb) thrust de Havilland Goblin centrifugal-flow turbojet

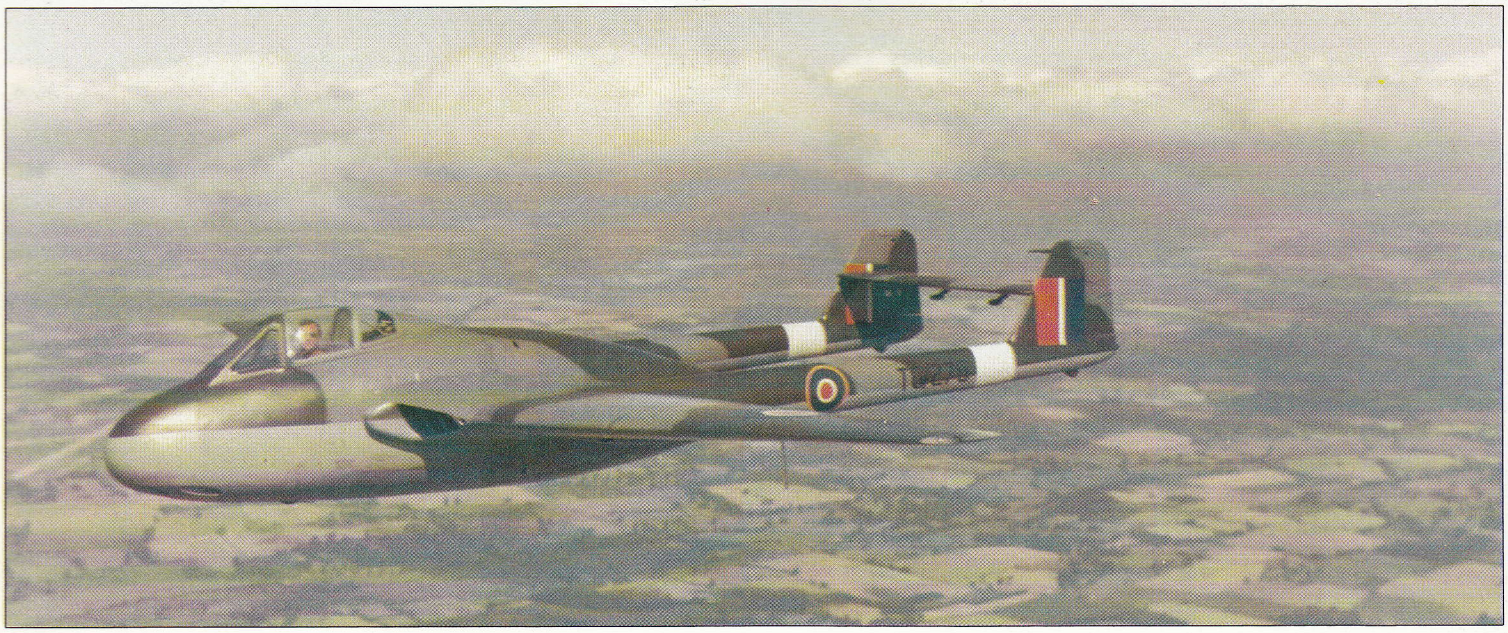
Performance: maximum speed 824 km/h (512 mph) at 10365 m (34,000 ft); initial climb 1235 m (4,050 ft) per minute; service ceiling 12620 m (41,400 ft); range 1190 km (740 miles)

Weights: empty 2803 kg (6,180 lb); maximum take-off 4627 kg (10,200 lb)

Dimensions: span 12.19 m (40 ft 0 in); length 9.37 m (30 ft 9 in); height 2.69 m (8 ft 10 in); wing area 24.71 m^2 (266.0 sq ft)

Armament: four 20-mm Hispano cannon under the nose

TG 278 was the fifth production Vampire F.Mk 1, all of which were built by English Electric to relieve de Havilland. The first 40 aircraft had Goblin I engines and carried an armament of four 20-mm cannon in the nose. Later versions had pressurized cockpits with bubble canopies.



UK

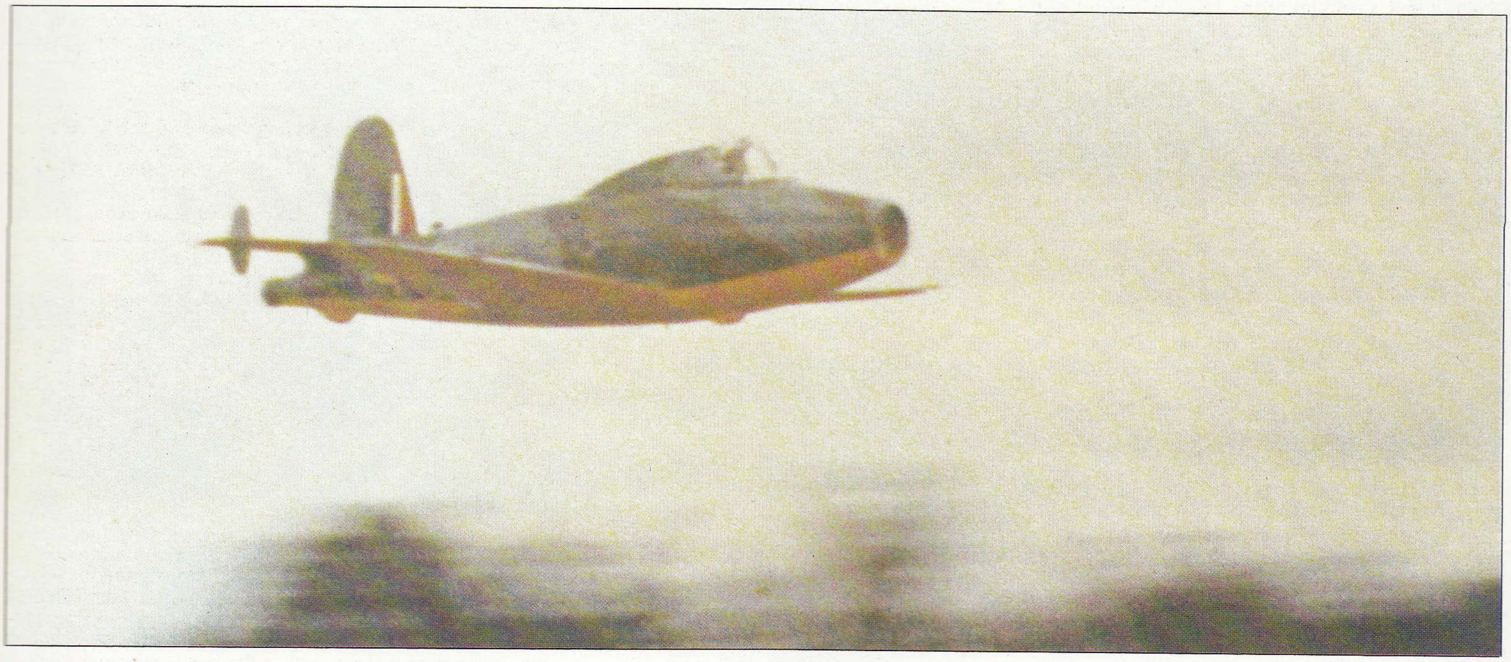
Gloster E.28/39

Assured of a place in aviation history, the **Gloster E.28/39** was the first British jet aircraft to fly. Although its design was based on possible fighter requirements (with weight and space allowance for an armament of four rifle-calibre machine-guns), the small low-wing aircraft was strictly a research vehicle intended to prove the flight characteristics of the pioneering Whittle W.1 reverse-flow gas turbine with centrifugal compressor. It was an attractive aircraft with nosewheel landing gear and nose inlet for the midships-mounted turbojet, which exhausted through the extreme rear fuselage. Specification E.28/39 was issued to the Gloster Aircraft Company on 3 February 1940; the first prototype underwent taxiing trials at Hucclecote in April 1941 and on 15 May that year was first flown by P.E.G. Sayer from Cranwell with a 390-kg (860-lb) thrust W.1 engine. On 4 February 1942 the aircraft was flown with a 526-kg (1,160-lb) thrust W.1A; on 30 July 1942, while flying with a 692-kg (1,526-lb) thrust Rover W.2B engine, the aircraft entered an inverted spin with jammed ailerons, forcing the RAE pilot to bale out. A second prototype had joined the test programme, and was powered by a 771-kg (1,700-lb) thrust Power Jets W.2/500 turbojet, later boosted to 798-kg (1,760-lb) thrust, and it was with this engine that the aircraft survived to be put on permanent exhibition in the South Kensington Science Museum.

Specification

Type: single-seat research aircraft
Powerplant: one 798-kg (1,760-lb) thrust Power Jets W.2/500 turbojet
Performance: maximum speed 750 km/h (466 mph) at 3050 m (10,000 ft); service ceiling 9753 m (32,000 ft)
Weights: empty 1309 kg (2,886 lb); maximum take-off 1700 kg (3,748 lb)
Dimensions: span 8.84 m (29 ft 0 in); length 7.72 m (25 ft 3¾ in); height 2.82 m (9 ft 3 in); wing area 13.61 m² (146.5 sq ft)
Armament: none

Two Gloster E.28/39s were built; one was lost in an accident and the other survived to be displayed in the Science Museum in London. It was fitted with provision for armament but remained as a research aircraft throughout its flying career.



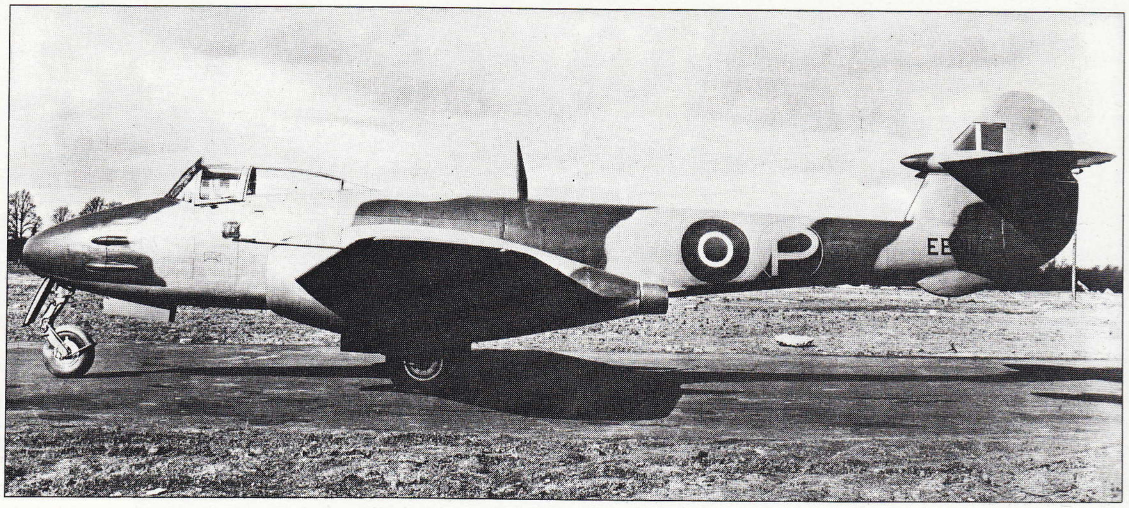
UK

Gloster Meteor

The **Gloster Meteor** was the only Allied jet aircraft to reach combat status during the war, and indeed survived in service with the RAF as a fighter for some 15 years afterwards. Designed by George Carter to Air Ministry Specification F.9/40, the aircraft employed twin engines owing to the low power available from turbojets early in the 1940s. Eight prototypes were built: the first had Rover W.2B engines, the second Power Jets W.2/500s, the third Metrovick F.2 axial-flow turbojets, the fourth W.2B/23 engines, the fifth Halford/de Havilland H.1s, the sixth (prototype **Meteor Mk II**) DH Goblin engines, the seventh also Goblins but with modified fin and rudder, and the eighth Rolls-Royce W.2B/37 Derwent Is. Although the first prototype was completed first and underwent taxiing trials in July 1942 at Newmarket, it was the fifth aircraft that was first flown on 5 March 1943 at Cranwell. The first production batch comprised 20 **Meteor Mk I** aircraft with Rolls-Royce W.2B/23 Welland I reverse-flow turbojets with centrifugal-flow compressors; roughly half of these were delivered to No. 616 Squadron at Culmhead in July 1944, and the squadron then moved to Manston where it flew operational sorties against the flying bombs being launched against southern England; the first such weapon was destroyed on 4 August. The squadron later moved to Belgium where it was joined by No. 504 Squadron with **Meteor Mk III** aircraft, also with Welland engines, but fitted with sliding hoods. One of the production Meteor Mk Is was shipped to the USA in exchange for a Bell YP-59A for evaluation purposes. Another was the world's first turboprop-powered aircraft, being fitted with two Rolls-Royce Trents, although this aircraft was not flown until two weeks after the end of the war.

Specification

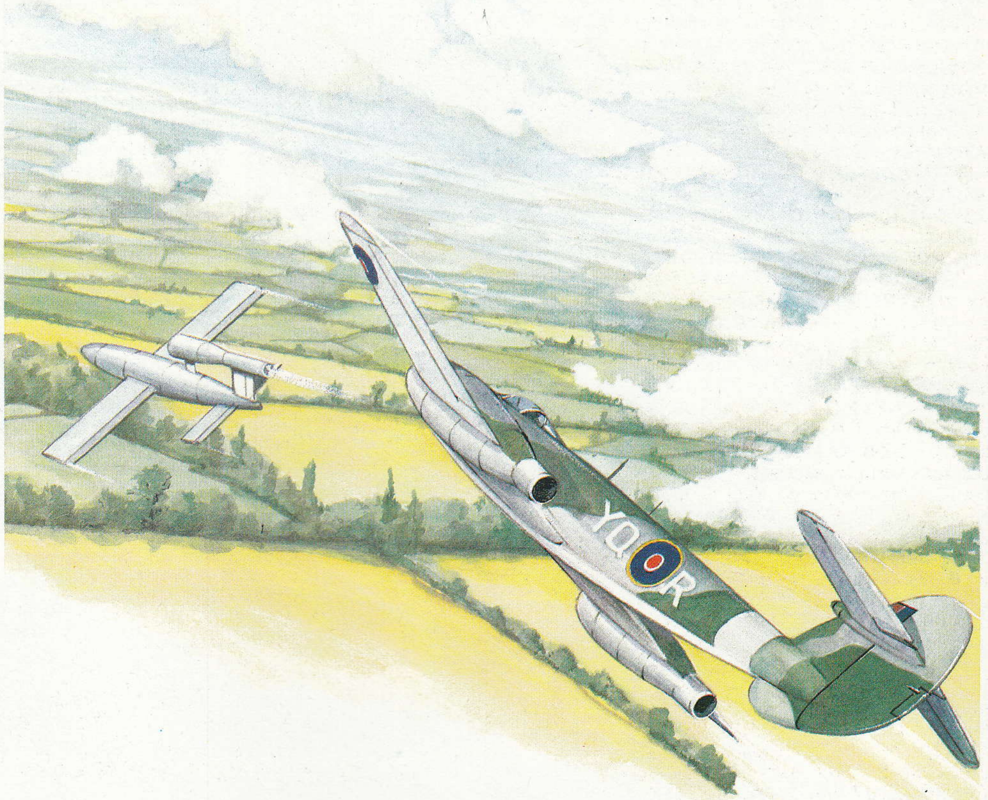
Meteor F.Mk I
Type: single-seat interceptor fighter
Powerplant: two 771-kg (1,700-lb) thrust Rolls-Royce Welland I turbojets
Performance: maximum speed 668 km/h (415 mph) at 3050 m (10,000 ft); service ceiling 12190 m (40,000 ft)
Weights: empty 3692 kg (8,140 lb); maximum take-off 6257 kg (13,795 lb)
Dimensions: span 13.11 m (43 ft 0 in); length 12.57 m (41 ft 3 in); height 3.96 m (13 ft 0 in); wing area 34.74 m² (374.0 sq ft)
Armament: four nose-mounted 20-mm Hispano cannon (provision for six)



EE211/G was the second production Meteor, an F.Mk 1. Armed with four 20-mm cannon and powered by two Welland I turbojets, it could reach a speed of 668 km/h (415 mph). Meteors provided good training for American bomber crews now faced with attacks from Me 262s.

Meteor in Service

The first Allied jet into service, the Meteor did not have the glorious war of the Me 262, but its 'anti-Diver' duties were legendary.



In contrast with the wealth of stories and photographs recording the operational career of Germany's Messerschmitt Me 262, the early combat career of the UK's Gloster Meteor twin-jet is little known. That it happened at all was entirely due to the vision and persistence (not to say utterly brilliant engineering capability) of one man, Frank Whittle. He knew all about axial compressors but, though this earned him extra hostility from his many detractors, he wisely decided to build his early turbojets with simple and tough centrifugal compressors.

This seemingly trivial point had important consequences; first, despite disgraceful government mismanagement which hamstrung the whole programme until January 1943 by giving it to the Rover Car Co., the W.2B engine matured fast enough to go into production later in 1943 with a far better standard of reliability than any of the German turbojets; and, second, when the Meteor reached the RAF not one pilot was killed in World War II because of an accident, in sharpest contrast with what happened in the Luftwaffe.

The Gloster F.9/40 Meteor first flew (with quite different engines made by de Havilland) on 5 March 1943. Once Rolls-Royce had taken over Whittle's engine from Rover things began to move, and the first production Meteor F.Mk I (EE210) flew on 12 January 1944. The first 20 were all built by mid-April and, after their undersides had been changed from yellow to silver, were delivered progressively to No. 616 Sqn, then based at Culmhead, Devon, from 12 July 1944. At this time 12 Me 262s had been taken on charge by Ekdo 262 in the Luftwaffe, but this was a test unit, not a regular squadron.

Into service

No. 616 Sqn moved to Manston, east Kent, in late July, where it was in the thick of V-1 flying-bomb country. Almost all of the squadron's Supermarine Spitfires had by this time been replaced by the new jets, and because chasing flying-bombs was in some ways simpler than fighting manned aircraft the Meteors were able to go into action straight away. The Meteor had been designed for six 20-mm Hispano cannon, but only four were in fact fitted, though every Meteor ever built had provision for the missing pair. Oddly, little air firing had been done, and on 27 July three pilots found persistent electrical faults were short-circuiting the gun-firing mechanism. Thus, the RAF jet's score was opened on 4 August by Flying Officer Dean, who resourcefully tipped a bomb over with his wingtip (this had already been done by a Spitfire F.Mk XIV). From then on the Meteors enjoyed outstanding serviceability, guns and all.

The pioneer cruise missiles came in at over 585 km/h (364 mph), some hitting over 645 km/h (401 mph), and near sea level this was far beyond the capability of most Allied fighters. North American P-51s, Griffon-engined Spitfires, Hawker Tempests and de Havilland Mosquitoes flogged on 130-grade fuel could all cope, but the Meteor naturally had no trouble at all, except on the score of flight endurance, which at low level was initially 35 to 40 minutes. By the end of August Flight Lieutenant Ellis, No. 616 Sqn's engineering officer, had refined piloting techniques to get endurance up to 90 minutes, while the pilots themselves had not only mastered their unfamiliar mounts but found in many respects they were easier to fly than their former Spitfires. Later Air Marshal Sir James Robb, commander-in-chief of Fighter Command, officially told Rolls-Royce that the two Welland I engines of the Meteor F.Mk I needed just half the man-hours of maintenance of the single Griffon of the Spitfires.

New engines

Rolls-Royce never rested on its laurels, and its new factory at Ashton-under-Lyme quickly switched to the even better 907-kg (2,000-lb) thrust Derwent I for the Meteor F.Mk III which discarded the messy side-hinged canopy for a more streamlined sliding hood giving a better all-round view and reduced drag. The Meteor F.Mk III was the first major production version, though strangely many of the first deliveries were painted white. This may have been an effort to prevent the Meteor from being mistaken for a German jet, as was the only No. 616 Sqn Meteor F.Mk I to be shot at in the first three months (by a Spitfire). The Meteor F.Mk III soon (October 1944) replaced the Meteor F.Mk I in No. 616 Sqn, one flight of which joined 2nd Tactical Air force near Brussels with strict instructions not to penetrate into Germany (it was said later, to prevent an aircraft falling into the hands of the Soviets, to whom the UK quickly sold engines much later than those fitted to these Meteors). They were joined in January 1945 by No. 504 Sqn, which saw much action against the dying Luftwaffe.

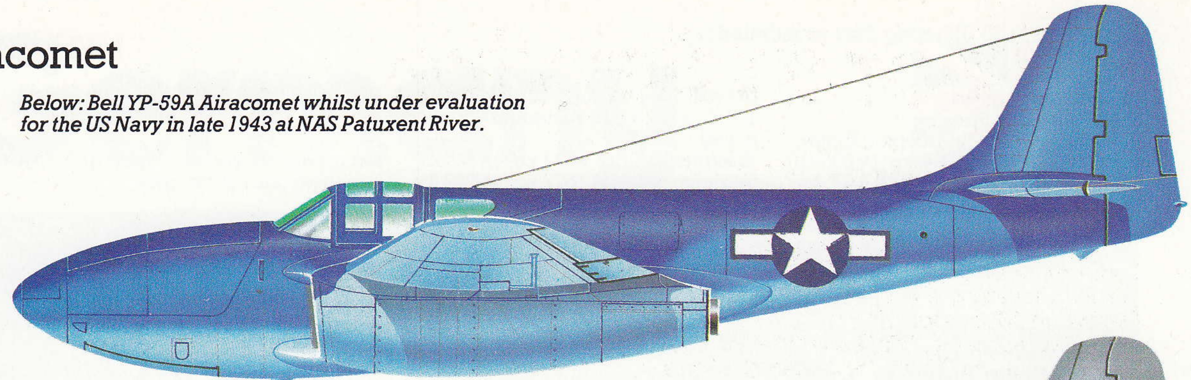
No. 616 Sqn, RAF was the first Allied unit to fly jet aircraft. Most of its duties were against flying bombs but in the last few months of the war several F.Mk IIIs from No. 616 Sqn went to Belgium on air combat and ground attack duties.

USA

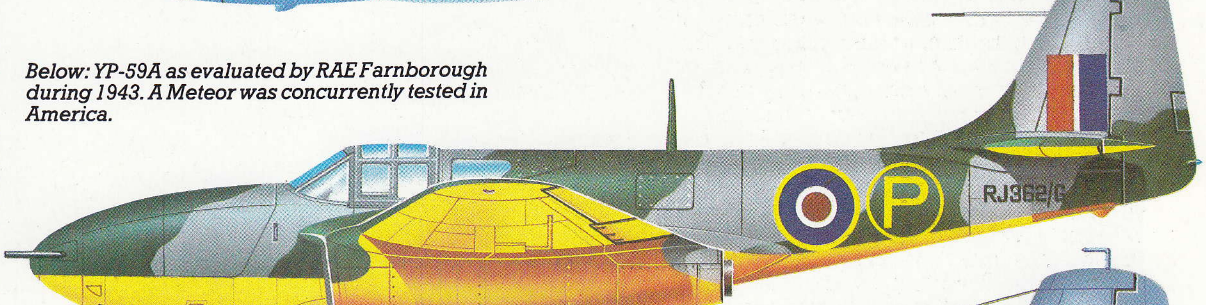
Bell P-59 Airacomet

In the almost total absence of work on gas turbines for aircraft in the USA before 1941, the UK undertook to supply the General Electric Company (which had worked on industrial turbines for many years) with details of Frank Whittle's progress to date. On account of the Bell Aircraft Corporation's proximity to General Electric's engine plant, that company was selected to develop a fighter around the USA's first turbojet on 5 September 1941. With a Whittle-type General Electric 1-A turbojet on each side of the fuselage beneath the wing roots, the **Bell Model 27** was designated the **XP-59A**, the first of three being flown by Robert M. Stanley at Muroc Dry Lake on 1 October 1942. Named **Airacomet**, 13 development **YP-59A** aircraft followed during 1943-4 with the more powerful General Electric I-16 (J31) turbojet, and these were used primarily to provide basic flight data on turbojets. Production orders for 20 **P-59A** aircraft with J31-GE-3 engines and 80 **P-59B** aircraft with J31-GE-5 engines were awarded but, as a result of successful development of the Lockheed P-80 Shooting Star the last 50 of the latter were cancelled as superfluous. All production had been completed by the end of the war and many of the aircraft were issued to a special USAAF unit, the 412th Fighter Group, for use as drones or drone controllers, some aircraft having a second open cockpit in the nose for an observer. No P-59 ever achieved operational status, being found to lack adequate performance, although a single YP-59A was shipped to the UK for evaluation at the Royal Aircraft Establishment and the Aeroplane & Armament Experimental Establishment late in 1943.

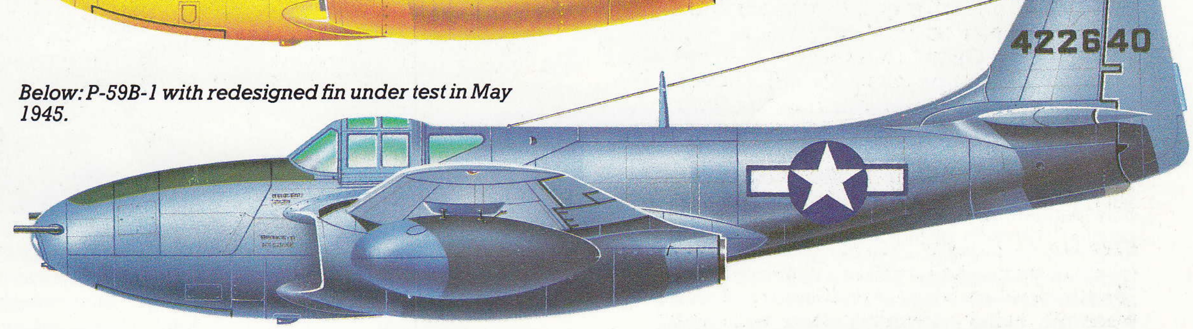
Below: Bell YP-59A Airacomet whilst under evaluation for the US Navy in late 1943 at NAS Patuxent River.



Below: YP-59A as evaluated by RAE Farnborough during 1943. A Meteor was concurrently tested in America.



Below: P-59B-1 with redesigned fin under test in May 1945.

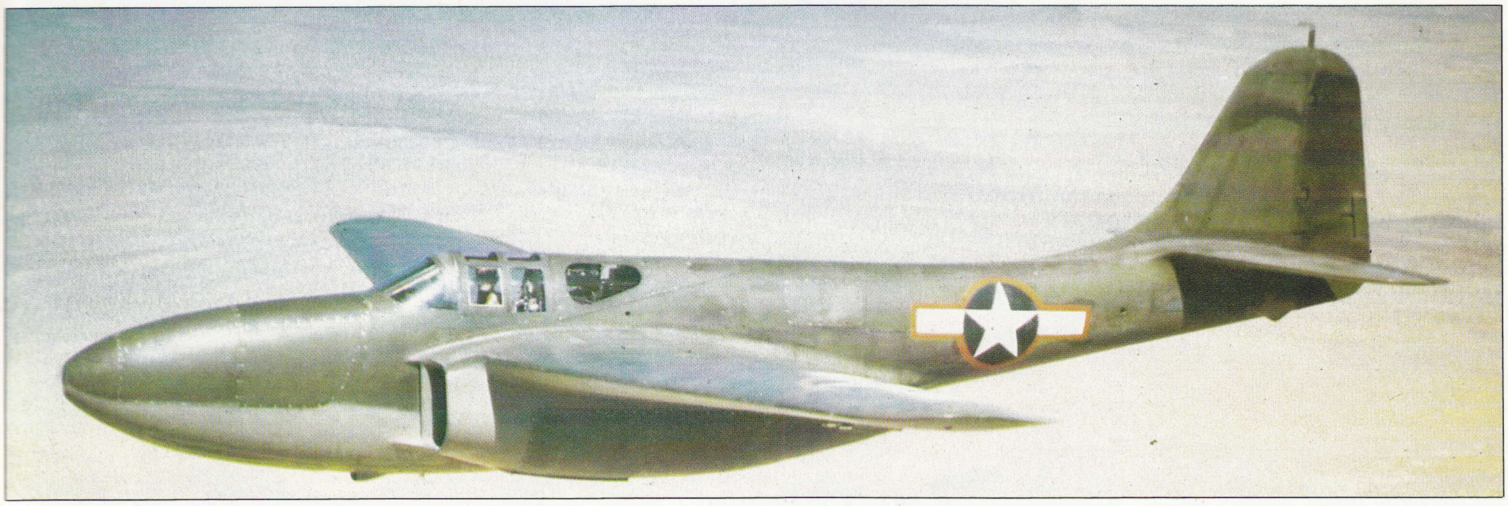


Specification

P-59B Airacomet

Type: single-seat interceptor fighter
Powerplant: two 907-kg (2,000-lb) thrust General Electric J31-GE-5 turbojets
Performance: maximum speed 658 km/h (409 mph) at 10670 m (35,000 ft); climb to 3050 m (10,000 ft) in 3 minutes 20 seconds; service ceiling 14040 m (46,200 ft); range 644 km (400 miles)
Weights: empty 3704 kg (8,165 lb); maximum take-off 6214 kg (13,700 lb)
Dimensions: span 13.87 m (45 ft 6 in); length 11.62 m (38 ft 1½ in); height 3.66 m (12 ft 0 in); wing area 35.84 m^2 (385.8 sq ft)
Armament: one 20-mm M4 cannon and three 12.7-mm (0.5-in) machine-guns in the nose

Below: The first three prototypes (XP-59A) featured a flush canopy – later models having a stepped canopy. The P-59 was ordered in production but the P-80 was preferred, and the Airacomet never saw service, lacking adequate performance.



USA

Lockheed P-80 Shooting Star

The second American jet fighter to fly during the war was the **Lockheed P-80 Shooting Star**, two development examples of which reached the Italian war zone just before VE-day, but failed to fly an operational sortie. Designed under the leadership of Clarence L. Johnson around the British Halford (de Havilland) H.1 turbojet of 1361-kg (3,000-lb) thrust, the first prototype **XP-80** was flown at Muroc Dry Lake by Milo Burcham on 8 January 1944, only 143 days after the start of the project. The next two prototypes were designated **XP-80A** and were powered by the Allison-developed General Electric J33 engine of 1814-kg (4,000-lb) thrust, the first being flown by Tony Le Vier on 10 June 1944. With low-set equitapered laminar-flow wings and engine air intakes set into the fuselage just forward of the wing roots, this version had a top speed of 898 km/h (558 mph) at sea level. Thirteen development **YP-80A** aircraft for service trials, with J33-GE-9 or J33-GE-11 engines and an armament of six machine-guns in the nose, started delivery to test establishments in October 1944 and it was aircraft of this type that arrived in Italy in May 1945. Production deliveries of the **P-80A** did not start until December that year, however, four months too late to see action against the Japanese. Subsequently the P-80 gave long and valuable service in the post-war USAF (particularly in the Korean War of 1950-3).

Lockheed P-80 Shooting Star (continued)

Specification

P-80A Shooting Star

Type: single-seat interceptor fighter

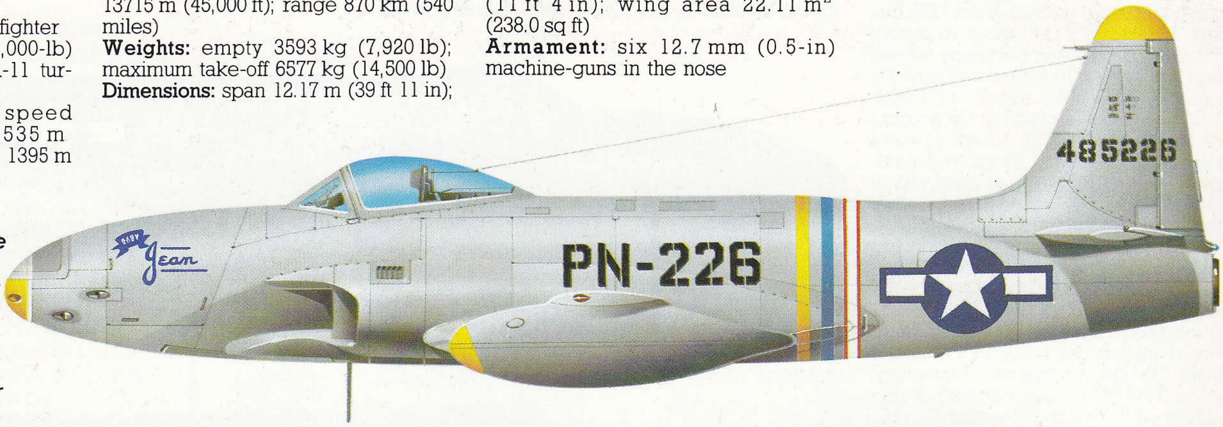
Powerplant: one 1814-kg (4,000-lb) thrust General Electric J33-A-11 turbojet

Performance: maximum speed 933 km/h (580 mph) at 8535 m (28,000 ft); initial climb rate 1395 m (4,580 ft) per minute; service ceiling 13715 m (45,000 ft); range 870 km (540 miles)

Weights: empty 3593 kg (7,920 lb); maximum take-off 6577 kg (14,500 lb)

Dimensions: span 12.17 m (39 ft 11 in); length 10.52 m (34 ft 6 in); height 3.45 m (11 ft 4 in); wing area 22.11 m^2 (238.0 sq ft)

Armament: six 12.7 mm (0.5-in) machine-guns in the nose



The P-80 was powered by a J33 engine which replaced the British Halford H.1. Through its developments it became the most successful first-generation jet, leading to the T-33 trainer and the F-94 Starfire. This is a P-80A-1-LO serving with the 412th Fighter Group in 1946.

USSR

Berez-Isa BI

Under the direction of Prof. Viktor Bolkhovitinov, with detail design by Aleksandr Bereznyak and Aleksei Isayev (accounting for the BI of the designation), the **Berez-Isa BI** was the first liquid rocket-engined fighter flown in the USSR. A low-wing monoplane, the BI had a Dushkin D-1A rocket engine in the tail, and this was highly temperamental, its volatile fuel mixture of kerosene and nitric acid being not only dangerous to handle, but also causing corrosion of tanks and fuel lines. The BI was flown initially as a glider on 10 September 1941, the first significant powered flight of 3 minutes 9 seconds, being made by the third prototype on 15 May 1942. Work on 50 pre-production aircraft was started, but halted when a prototype dived into the ground on 27 March 1943 during a low-level high-speed run, killing its pilot. The endurance of the BI was inadequate for operational use, but a two-chamber engine developed by Dushkin to overcome this deficiency, with low (cruising) and high (combat) thrust settings was almost double the weight and considered unsuitable. Wind tunnel testing that followed the fatal crash revealed a stability problem that could not be resolved and further development was abandoned. Before this, however, the seventh prototype with a more powerful engine had demonstrated a rate of climb of 4980 m (16,340 ft) per minute.

Specification

Powerplant: one 1000-kg (2,205-lb) thrust Dushkin D-1A rocket engine

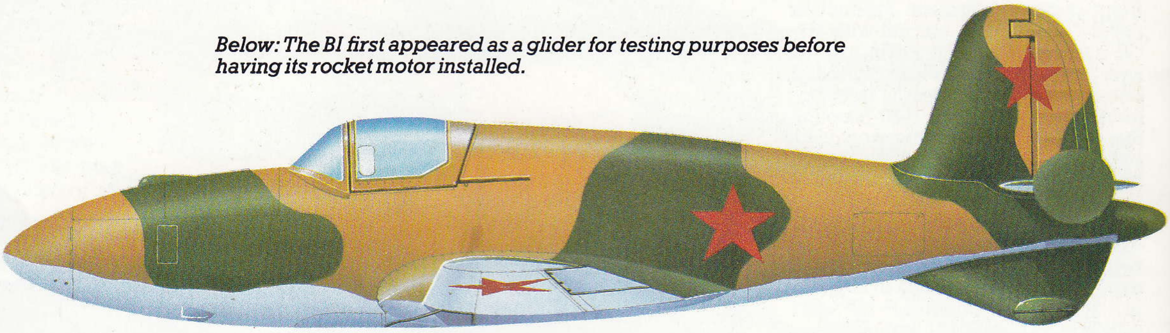
Performance: (estimated) maximum speed 1000 km/h (621 mph) at 5000 m (16,405 ft); climb to 10000 m (32,810 ft) in 59 seconds; endurance 8 to 15 minutes

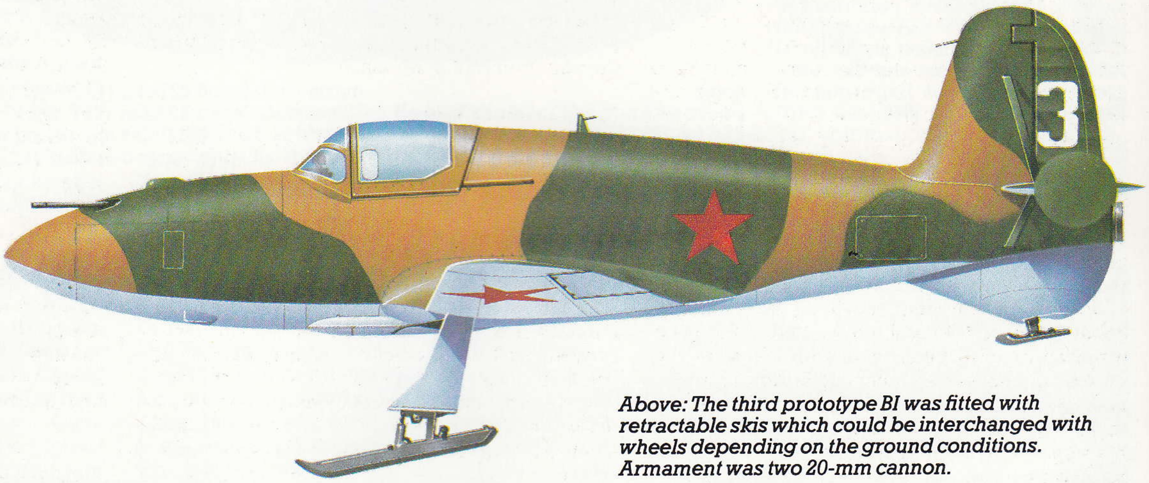
Weights: empty 958 kg (2,112 lb); maximum take-off 1683 kg (3,710 lb)

Dimensions: span 6.48 m (21 ft 3 in); length 6.40 m (21 ft 0 in); wing area 7.00 m^2 (75.35 sq ft)

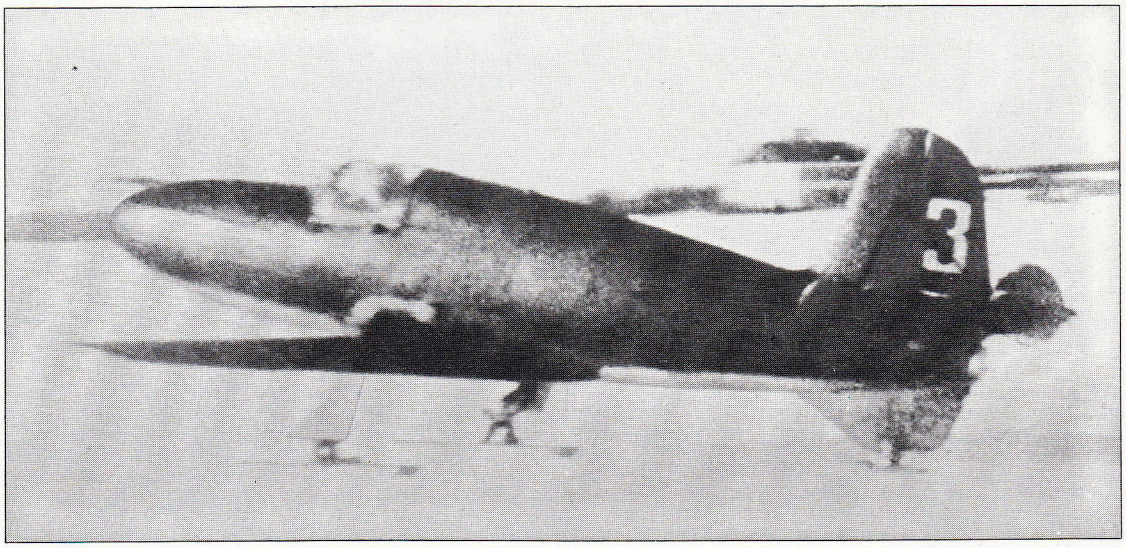
Armament: two nose-mounted 20-mm ShVAK cannon

Below: The BI first appeared as a glider for testing purposes before having its rocket motor installed.





Above: The third prototype BI was fitted with retractable skis which could be interchanged with wheels depending on the ground conditions. Armament was two 20-mm cannon.



The third prototype Berez-Isa (Bolkhovitinov) BI seen taking off on its first powered flight. Performance in terms of speed and rate of climb were phenomenal, but the aerodynamics showed insoluble stability problems and the project was abandoned.

RAF Germany

Important members of RAF Germany are the Jaguar squadrons, intended for battlefield support. These two are from No. 20 Sqn.

Newsreels of May 1945 showed jubilant British and American troops greeting their Soviet counterparts with handshakes and exchanges of mementoes as the two forces met somewhere in the middle of what had recently been the Third Reich after their respective eastward and westward armoured thrusts. Apart from a slight political readjustment of the dividing line soon afterwards, the armies have remained in position to this day, although few smiles now pass between those who were previously allies united in a single cause.

The dividing line between two diametrically opposed systems runs through Germany, and its Western sector forms the hub of Free Europe's defensive posture, the local armed forces being augmented by permanently based troops and aircraft from other nations, including the UK.

Royal Air Force Germany embraces the UK's commitment to NATO air power on the European mainland, drawing, when required in an emergency, on the home-based elements of Strike Command, with which it has equal status as one of the RAF's three major components. Unlike Strike Command, however, RAFG is a pure fighting force, possessing no conversion units or extraneous formations apart from one small communications unit amongst its 14 squadrons.

Five bases constitute the command, of which Gatow, in West Berlin, serves as the British airhead for contingency operations and possesses only a couple of de Havilland Chipmunks for familiarization flying. The combat airfields are Gütersloh, east of the Rhine, and Brüggen, Laarbruch and Wildenrath close to the Dutch border. The location may at first appear strange in view of the logical direction of a Warsaw Pact attack, but a realistic analysis of likely events must concede that bases close to the Iron Curtain would be overwhelmed within the first few hours of an assault.

In conjunction with the Allied air forces, RAFG is charged with delaying an invading army to give sufficient time for NATO ground forces and their emergency reinforcements to form a defensive line, and thus the airfields are well situated in the far west.

Administratively, RAFG is grouped with the Belgian and Dutch air forces as well as the northern elements of the Luftwaffe and USAF Europe to form the 2nd Allied Tactical Air Force, whose overall commander is always the British officer controlling RAFG. Agreed by its partners to be the most efficient air force in the 2nd ATAF, RAFG can adopt a total war posture in a mere one-third of the NATO-stipulated time, although to be fair it must be pointed out that being based in one's home country detracts from optimum readiness.

Capabilities enhanced

November 1983 witnessed the beginning of a major improvement programme for RAFG strike/attack forces, when No. 15 Squadron at Laarbruch re-formed as the first of a projected eight Panavia Tornado GR.Mk 1 units within the command, having discarded its BAe Buccaneer S.Mk 2Bs a few months earlier. Hailed as the most potent interdictor in the world, capable of undertaking missions at ultra-low level and delivering its ordnance (nuclear or conventional) with pinpoint accuracy, the Tornado had been eagerly awaited by RAFG and its allies.

As yet, though, the aircraft does not possess the full range of weaponry, for in the pipeline are the Hunting JP 233 bomblet dispenser for airfield attack (known as 'counter-air' operations) and the BAeD Alarm missile for neutralizing enemy radar transmitters. At present the Tornado works with 454-kg (1,000-lb) bombs and cluster bombs (CBUs), plus its defensive fit of two Sidewinder AAMs and Sky Shadow jamming pods.

Further Tornado squadrons are now forming in RAFG at approximately four-monthly intervals, and with replacement of the Buccaneer its first priority No. 16 Squadron, also at Laarbruch, is next to convert. Many will be sorry to see the last of the Buccaneer, its stability at relatively high speeds having given it the reputation of being a sturdy and dependable weapons platform, despite its ageing avionics.

The two-seat Buccaneer has been partnered in the strike/attack role by the one-man SEPECAT Jaguar GR.Mk 1, armed with 30-mm cannon, 454-kg (1,000-lb) bombs (free-fall, retarded or laser guided) and BL 755 cluster bombs, plus a chaff dispenser in the tailcone and (since 1978) a Sidewinder, the two last-mentioned being provided for self-defence. Despite its use of a very capable inertial navigation system, the Jaguar cannot be regarded as a true all-weather aircraft for strikes against airfields, choke points or battlefield targets as it lacks the terrain-following capability now regarded as essential for successful execution of such missions in the face of sophisticated defence.

Thus the Tornado will represent a significant upgrading of combat ability when it begins to replace Jaguars during 1984. The four squadrons now at Bruggen will receive Tornados, although the first is expected to convert and remain at Laarbruch, giving these two bases a complement of three units apiece. Later, No. 9 Squadron will move from the UK, and a tactical reconnaissance unit will be established when the Laarbruch-based Jaguars of No. 2 Squadron are supplanted by a specially-equipped version of the Tornado in 1986. At present, No. 2 Squadron's Jaguars carry a substantial reconnaissance pod on the fuselage centreline pylon, but they may also be fitted with CBUs for attack missions.

A new dimension to RAF Germany is the hardened air shelters (HAS), which allow aircraft to operate whilst under limited attack.

12 PASS (8)

The Harrier is tailor-made for Germany, being able to operate away from its parent airfield. Here a field crew changes an engine in a portable hangar, which can be erected wherever a truck can reach.

Unique aircraft

Carrying a similar armament to the Jaguar, but with the important and unique addition of STOVL, are the BAe Harriers of Nos 3 and 4 Squadrons at Gütersloh, the latter unit having a secondary reconnaissance role for which its aircraft are equipped with an underfuselage optical camera pod (lacking the infra-red linescan of the Jaguar's fitment). In the past few years, Harriers have resumed use of SNEB rocket pods, these giving a marginal stand-off capability against armoured targets compared with the CBU.

Regularly exercising off-base to practise close support of the army from concealed sites near the front line, the Harriers are far more adaptable than other land-based aircraft, although the operational value of just two squadrons, when the rest of NATO's fixed-wing inventory is tied to vulnerable airfields, must be questioned.

Nevertheless, the small RAFG STOVL force will remain beyond the end of the century, the present Harrier GR.Mk 3 giving way to the US-developed McDonnell Douglas AV-8B Harrier GR.Mk 5 from 1987 onwards. BAe is building 60 of these advanced Harriers exclusively for use in Germany, those not immediately needed for the two squadrons or a small conversion flight at home forming the attrition reserve.

For historical reasons, dating back to 1945, the peacetime air defence of West Germany can be conducted only by RAF, USAF or French aircraft, the Luftwaffe interceptor units being brought into play if a shooting war develops, and not before. France having abandoned the responsibility in 1966, two squadrons of RAFG McDonnell Douglas Phantom FGR.Mk 2s at Wildenrath share 'policing' duties in German skies with American McDonnell Douglas F-15 Eagles, their role being to investigate all unauthorized aircraft in the Air Defence Identification Zone, a strip of forbidden airspace on the western side of the East-West German border.

This is work for which the Tornado F.Mk 2 was designed, but the Phantoms will continue at Wildenrath for the foreseeable future. What will eventually replace them, in the mid-1990s, is by no means clear.

Tactical helicopters

Unarmed, apart from the occasional light machine-gun, is the tactical helicopter force, assigned to I (British) Corps, forming BAOR. Two squadrons based at Gütersloh fly the Aérospatiale Puma and (from 1983) the Boeing Vertol Chinook, their operational station being in the field, close to the army, for resupply, casualty evacuation and general transport duties. It will be noted that air transport of troops is not included, for there is insufficient capacity within the two units to carry a worthwhile number of soldiers in a single wave into battles of the size envisaged in a European war. The only possible exception may be on behalf of the 6th Brigade, which has a rapid intervention role in any threatened area of BAOR responsibility.

This aside, the army has found the Chinook a valuable asset, as its 10-ton payload enables it to carry such items as a complete Rapier SAM unit (Land-Rover, reload trailer and men inside; fire unit and second Land-Rover slung below), or act as a 'bridge' for ferrying vehicles over a natural obstacle such as a deep river. Furthermore, its three external cargo hooks allow it to drop supplies off to that number of positions without the delay of landing and inloading in a hostile environment, a point appreciated by crew and 'customer' alike.

Chinook, Tornado and (to come) Harrier GR.Mk 5: RAF Germany consistently receives the best of what is available in the UK and enjoys priority in manpower and other resources, even to the extent of being fully staffed when units at home are below strength. There can be no better demonstration than this of the UK's resolve to meet its obligations to the rest of Western Europe.

RAF GERMANY ORDER OF BATTLE
RAF Germany HQ: Rheindahlen

Unit	*Base*	*Aircraft*	*Role*
No. 2 Sqn	Laarbruch	Jaguar GR.Mk 1	tactical recce/close support
No. 3 Sqn	Gütersloh	Harrier GR.Mk 3	close support
No. 4 Sqn	Gütersloh	Harrier GR.Mk 3	close support/tactical recce
No. 14 Sqn	Brüggen	Jaguar GR.Mk 1	strike/attack
No. 15 Sqn	Laarbruch	Tornado GR.Mk 1	strike/attack
No. 16 Sqn	Laarbruch	Buccaneer S.Mk 2B	strike/attack
No. 17 Sqn	Brüggen	Jaguar GR.Mk 1	strike/attack
No. 18 Sqn	Gütersloh	Chinook HC.Mk 1	transport support
No. 19 Sqn	Wildenrath	Phantom FGR. Mk 2	air defence
No. 20 Sqn	Brüggen	Jaguar GR. Mk 1	strike/attack
No. 31 Sqn	Brüggen	Jaguar GR.Mk 1	strike/attack
No. 60 Sqn	Wildenrath	Pembroke C.Mk 1	communications
No. 92 Sqn	Wildenrath	Phantom FGR.Mk 2	air defence
No. 230 Sqn	Gütersloh	Puma HC.Mk 1	transport support
No. 431 MU	Brüggen	nil	aircraft repair/modification; ordnance and general storage

Abbreviation

MU Maintenance Unit